THE BRICKBVILDER

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PLATE ILLUSTRATIONS

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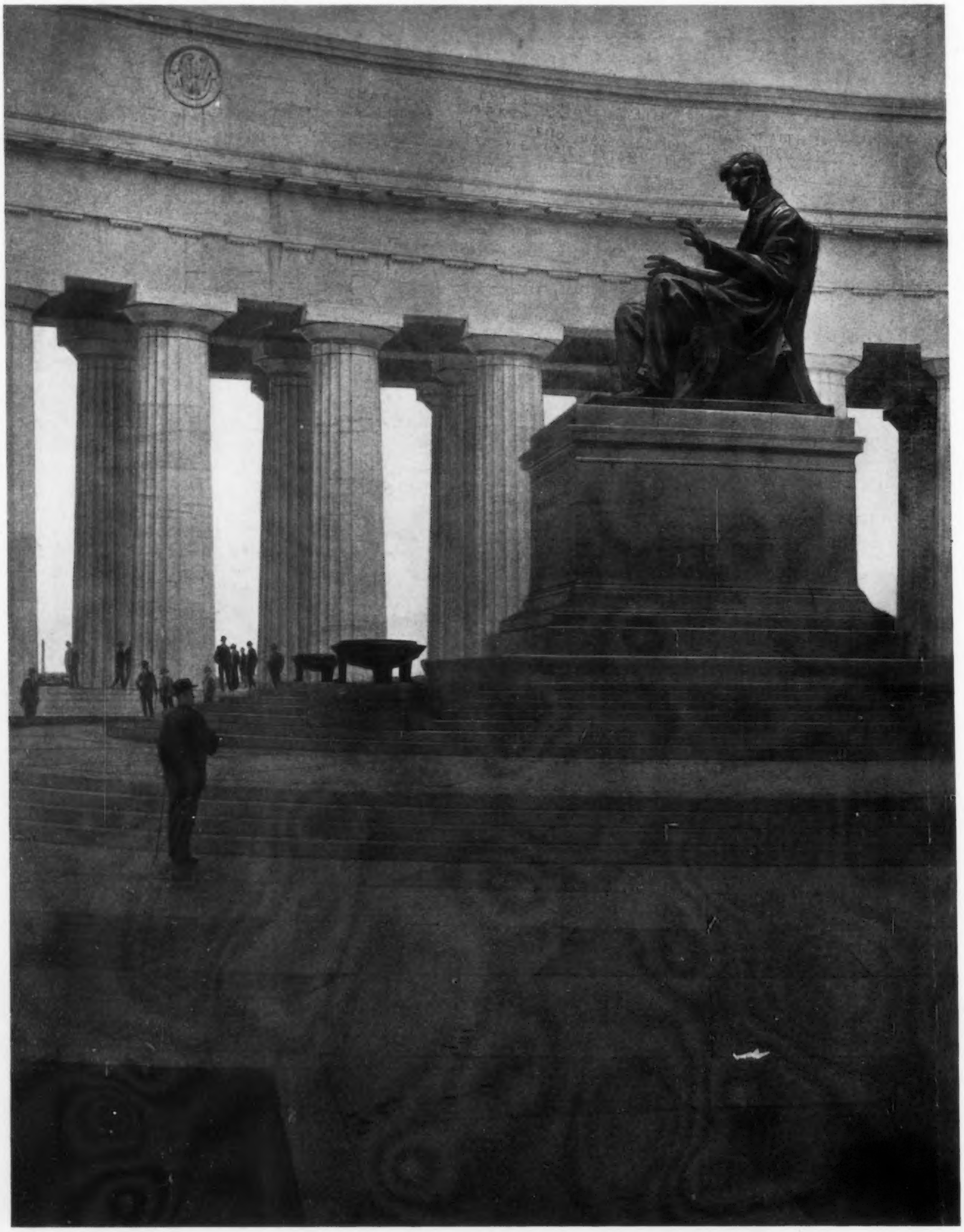


DESIGN SUBMITTED FOR THE LINCOLN MEMORIAL, WASHINGTON, D. C.
BY JOHN RUSSELL POPE, ARCHITECT.

OTTO R. EGGERS, DELINEATOR.

See article on page 7.

THE BRICKBVILDER

VOLUME XXIII JANUARY, 1914 NUMBER 1

Architectural Acoustics.

BUILDING MATERIAL AND MUSICAL PITCH.

By WALLACE C. SABINE.
Harvard University.

THE absorbing power of the various materials that enter into the construction and furnishing of an auditorium is but one phase in the general investigation of the subject of architectural acoustics which the writer has been prosecuting for the past eighteen years. During the first five years the investigation was devoted almost exclusively to the determination of the coefficients of absorption for sounds having the pitch of violin C (512 vibrations per second). The results were published in the *American Architect* and the *Engineering Record* in 1900. It was obvious from the beginning that an investigation relating only to a single pitch was but a preliminary excursion, and that the complete solution of the problem called for an extension of the investigation to cover the whole range in pitch of the speaking voice and of the musical scale. Therefore during the years which have since elapsed the investigation has been extended over a range in pitch from three octaves below to three octaves above violin C. That it has taken so long is due to the fact that other aspects of the acoustical problem also pressed for solution, such for example as those depending on form,— interference, resonance, and echo. The delay has also been due in part to the nature of the investigation which has necessarily been opportunist in character and, given every opportunity, somewhat laborious and exhausting. Some measure of the labor involved may be gained from the fact that the investigation of the absorption coefficients for the single note of violin C required every other night from twelve until five for a period of three years.

While many improvements have been made in the methods of investigation and in the apparatus employed since the first paper was published fourteen years ago, the present paper is devoted solely to the presentation of the results. I shall venture to discuss, although briefly, the circumstances under which the measurements were made, my object being to so interest architects that they will call attention to any opportunities which may come to their notice for the further extension of this work; for, while the absorbing powers of many materials have already been determined, it is evident that the list is still incomplete. For example, the coefficient of glass has been determined only for the note first studied, C, an octave above middle C. In 1898 the University had just completed the construction of some greenhouses in the Botanical Gardens, which, before the plants were moved in, fulfilled admirably the conditions necessary for accurate experimenting. Glass formed a very large part of the area of the enclosing surfaces, all, in fact, except the floor, and this was of concrete whose coefficient of absorption was low and had already been determined with accuracy. By this good fortune it was possible to determine the absorbing power of single-thickness glass. But at that time the apparatus was adapted only to the study of one note; and as the greenhouse was soon fully occupied with growing plants which could not be moved without danger, it was no longer available for the purpose when the scope of the investigation was extended. Since then no similar or nearly so good opportunity has presented itself, and the absorbing power of this important structural surface over the range of the musical scale has not as yet been determined. There was what seemed for the moment to be an opportunity for obtaining this data in an indoor tennis court which Messrs. McKim, Mead, and White, were erecting at Rhinebeck on the Hudson, and the architects undertook to secure the privilege of experimenting in the room, but inquiry showed that the tennis court was of turf, the absorption of which was so large and variable as to prevent an accurate determination of the coefficients for the glass. The necessary conditions for such experiments are that the material to be investigated shall be large in area, and that the other materials shall be small in area, low in power of absorption, and constant in character; while a contributing factor to the ease and accuracy of the investigation is that the room shall be so located as to be very quiet at some period of the day or night. The present paper is therefore a report of progress as well as an appeal for further opportunities, and it is hoped that it will not be out of place at the end of the paper to point out some of the problems which remain and ask that interested architects call attention to any rooms in which it may be possible to complete the work.

The investigation does not wholly wait on opportunity. A special room, exceptionally well adapted to the purpose in size, shape, and location, has been constantly available for the research in one form or another. This room, initially lined with brick set in cement, has been lined in turn with tile of various kinds, with plaster, and with plaster on wood lath, as well as finished from time to time in other surfaces. This process, however, is expensive, and carried out in completeness would be beyond what could be borne personally. Moreover, it has further limitations. For example, it is not possible in this room to determine the

absorbing power of glass windows, for one of the essential features of a window is that the outside space to which the sound is transmitted shall be open and unobstructed. An inner lining of glass, even though this be placed several inches from the wall, would not with certainty represent normal conditions or show the effect of windows as ordinarily employed in an auditorium. Notwithstanding these limitations, this room, carefully studied in respect to the effects of its peculiarities of form, especially such as arise from interference and resonance, has been of great service.

WALL AND CEILING SURFACES.

It is well to bear in mind that the absorption of sound by a wall surface is structural and not superficial. That it is superficial is one of the most widespread and persistent fallacies. When this investigation was initially undertaken in an endeavor to correct the acoustics in the lecture room of the Fogg Art Museum, one of the first suggestions was that the walls were too smooth and should be roughened. The proposal at that time was that the walls be replastered and scarred with the toothed trowel in a swirling motion and then painted, a type of decoration common twenty years ago. A few years later inquiries were received in regard to sanded surfaces, and still later in regard to a rough, pebbly surface of untroweled plaster; while within the past three years there have been many inquiries as to the efficiency of roughened brick or of rough hewn stone. On the general principle of investigating any proposal so long as it contained even a possibility of merit, these suggestions were put to test. The concrete floor of a room was covered with a gravel so sifted that each pebble was about one-eighth of an inch in diameter. This was spread over the floor so that pebble touched pebble, making a layer of but a single pebble in thickness. It showed not the slightest absorbing power, and there was no perceptible decrease in reverberation. The room was again tried with sand. Of course it was not possible in this case to insure the thickness of a single grain only, but as far as possible this was accomplished. The result was the same. The scarred, the sanded, the pebbly plaster, and the rough hewn stone are only infinitesimally more efficient as absorbents than the same walls smooth or even polished. The failure of such roughening of the wall surfaces to increase either the absorption or the dispersion of sound reflected from it is due to the fact that the sound waves, even of the highest notes, are long in comparison with the dimensions of the irregularities thus introduced.

The absorption of sound by a wall is therefore a structural phenomenon. It is almost infinitely varied in the details of its mechanism, but capable of classification in a few simple modes. The fundamental process common to all is an actual yielding of the wall surface to the vibrating pressure of the sound. How much the wall yields and what becomes of the motion thus taken up, depends on the nature of the structure. The simplest type of wall is obviously illustrated by concrete without steel reinforcement, for in this there is the nearest approach to perfect homogeneity. The amount that this wall would yield would depend upon its dimensions, particularly its thickness, and upon the density, the elasticity, and the viscosity of the material. It is possible to calculate this directly from the elements involved, but the process would be neither interesting nor convincing to an architect. It is in every way more satisfactory to determine the absorbing power by direct experiment. A concrete wall was not available. In its stead, the next more homogeneous wall was investigated, an eighteen-inch wall of brick set in cement. This wall was a very powerful reflector and its absorbing power exceedingly slight. Without going into the details of the experiment, it will suffice here to say that this wall absorbed one and one-tenth per cent of the lowest note investigated, a C two octaves below middle C, having a vibration frequency of sixty-four per second; one and two-tenths per cent of sounds an octave in pitch higher; one and four-tenths per cent of sounds of middle C; one and seven-tenths per cent for violin C; two per cent for sounds having a pitch one octave above; two and three-tenths for two octaves above; and two and one-half per cent for sounds having a pitch three octaves above violin C, that is to say, 4094 vibrations per second, the highest note investigated. These may be written as coefficients of absorption thus:

C_1, .011; C_2, .012; C_3, .014; C_4, .017; C_5, .020; C_6, .023; C_7, .025.

There is a graphical method of presenting these results which is always employed in physics, and frequently in other branches of science, when the phenomenon under investigation is simply progressive and dependent upon a single variable. Whenever these conditions are satisfied — and they are usually satisfied in any well conducted investigation, — the graphical representation of the results takes the form of a diagram in which the results of the measurements are plotted vertically at horizontal distances determined by the variable condition. Thus in the adjacent diagram (Curve 1, Fig. I) the coefficients of absorption are plotted vertically, the varying pitch being represented by horizontal distances along the base line. Such a diagrammatic representation serves to reveal the accuracy of the work. If the phenomenon is a continuous one, the plotted points should lie on a smooth curve; the nearness with which they do so is a measure of the accuracy of the work if the points thus plotted are determined by entirely independent experiments. This form of diagrammatic representation serves another purpose in permitting of the convenient interpolation for values intermediate between observed values. The coefficients for each type of wall surface will be given both numerically and diagrammatically. In order to avoid confusion, the observed points have been indicated only on the curve for wood sheathing in Fig. I. It will suffice to say merely that the other curves on this diagram are drawn accurately through the plotted observations.

The next wall surface investigated was plaster on hollow terra cotta tile. The plaster coat was of gypsum hard plaster, the rough plaster being five-eighths of an inch in thickness. The result shows a slightly greater absorption due to the greater flexibility of a hollow tile wall rather than to any direct effect of the plaster. The difference, however, is not great. The numerical results are as follows (Curve 2, Fig. I):

C_1, .012; C_2, .013; C_3, .015; C_4, .020; C_5, .028; C_6, .040; C_7, .050.

C_1, is the lowest note, 64 vibrations per second; C_7, the

highest, 4,096 per second; the other notes at octave intervals between.

Plaster on an otherwise homogeneous sustaining wall is a first step in the direction of a compound wall, but a vastly greater step is taken when the plaster instead of being applied directly to the sustaining wall is furred to a greater or less distance. In a homogeneous wall, the absorption of sound is partially by communication of the vibration to the material of the wall, whence it is telephoned throughout the structure, and partly by a yielding of the wall as a whole, the sound being then communicated to outside space. In a compound wall in which the exposed surface is furred from the main structure of the wall, the former vibrates between the furring strips like a drum. Such a surface obviously yields more than would a surface of plaster applied directly to tile or brick. The energy which is thus absorbed is partly dissipated by the viscosity of the plaster, partly by transmission in the air space behind it, and partly through the furring strips to the main wall. The mechanism of this process is interesting in that it shows how the free standing plaster may absorb a great amount of sound and may present a greater possibility of resonance and of selective absorption in the different registers of pitch. It is obvious that we are here dealing with a problem of more complicated aspect. It is conceivable that the absorption coefficient should depend on the nature of the supporting construction, whether wood lath, wire lath, or expanded metal lath; on the distance apart of the studding, or the depth of the air space; or, and even more decidedly, on the nature of the plaster employed, whether the old lime plaster or the modern quick setting gypsum plaster. A start has been made on a study of this problem, but it is not as yet so far advanced as to permit of a systematic correlation of the results. It must suffice to present here the values for a single construction. The most interesting case is that in which lime plaster was applied to wood lath, on wood studding at fourteen-inch spacing, forming a two-inch air space. The coefficients of absorption before the finishing coat was put on were (Curve 3, Fig. I):

C_1, .048; C_2, .020; C_3, .024; C_4, .034; C_5, .030; C_6, .028; C_7, .043.

The values after the finishing coat was put on were as follows (Curve 4, dotted, Fig. I):

C_1, .036; C_2, .012; C_3, .013; C_4, .018; C_5, .045; C_6, .028; C_7, .055.

It should be remarked that the determination of these coefficients was made within two weeks after the plaster was applied and also that the modern lime is not the same as the lime used thirty years ago, either in the manner in which it is handled or in the manner in which it sets and dries. It is particularly interesting to note in these observations, more clearly in the plotted curves, the phenomenon of resonance as shown by the maxima, and the effect of the increased thickness produced by the skim coat in increasing the rigidity of the wall, decreasing its absorbing power, and shifting the resonance.

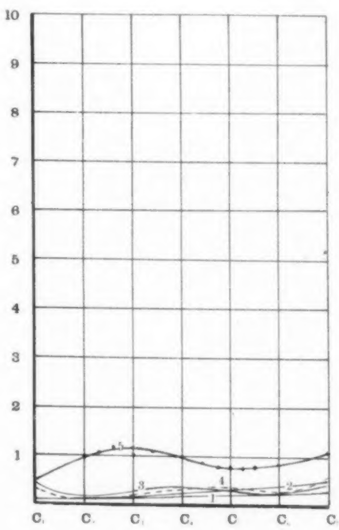


Fig. I.

Absorbing power for sounds varying in pitch from C = 64 to C = 4,096: 1, brick wall; 2, plaster on terra cotta hollow tile; 3, plaster on wire lath; 4, same with skim coat; 5, wood sheathing.

The most firmly established traditions of both instrumental and architectural acoustics relate to the use of wood and excite the liveliest interest in the effect of wood sheathing as an interior surface for auditoriums; nor are these expectations disappointed when the phenomenon is submitted to exact measurement. It was not easy to find satisfactory conditions for the experiment, for not many rooms are now constructed in which plaster on studding and sufficiently thin forms a very considerable factor. After long waiting a room suitable in every respect, except location, became available. Its floor, its whole wall, indeed, its ceiling was of pine sheathing. The only other material entering into its construction was glass in the two windows and in the door. Unfortunately, the room was on a prominent street, and immediately adjacent was an all-night lunch room. Accurate experiments were out of the question while the lunch room was in use, and it was, therefore, bought out and closed for a few nights. Even with the freedom from noise thus secured, the experiments were not totally undisturbed. The traffic past the building did not stop sufficiently to permit of any observations until after two o'clock in the morning and began again by four. During the intervening two hours it was possible to snatch periods for observation, but even these periods were disturbed through the curiosity of passers and the more legitimate concern of the police.

Anticipating the phenomenon of resonance in wood in a more marked degree than in any other material, new apparatus was designed permitting of measurements at more frequent intervals of pitch. The new apparatus was not available when the work began and the coefficients for the wood were determined at octave intervals, with results as follows:

C_1, .064; C_2, .098; C_3, .112; C_4, .104; C_5, .081; C_6, .082; C_7, .113.

These results when plotted showed clearly a very marked resonance. The more elaborate apparatus was hastened to completion and the coefficients of absorption determined for the intermediate notes of E and G in each of the middle four octaves. The results of both sets of experiments when plotted together give Curve 5 in Fig. I. The accuracy with which these fourteen points fall on a smooth curve drawn through them is all that could be expected in view of the conditions under which the experiment was conducted and the limited time available. Only one point falls far from the curve, that for middle C (C_3, 256). The general trend of the curve, however, is established beyond reasonable doubt. It is interesting to note the very great differences between this curve and those obtained for solid walls, and even for plastered walls. It is especially interesting to note the great absorption due to the resonance between the natural vibration of the walls and the sound,

and to observe that this maximum point of resonance lies in the lower part, although not in the lowest part, of the range of pitch tested. The pitch of this resonance is determined by the nature of the wood, its thickness, and the distance apart of the studding on which it is supported. The wood tested was North Carolina pine, five-eighths of an inch in thickness and on fourteen-inch studding. It is, perhaps, not superfluous to add at this time that a denser wood would have had a lower pitch for maximum resonance, other conditions being alike; an increased thickness would have raised the pitch of the resonance; while an increased distance between the studding would have lowered it. Finally it should be added that the best acoustical condition both for music and for speaking would have been with the maximum resonance an octave above rather than at middle C.

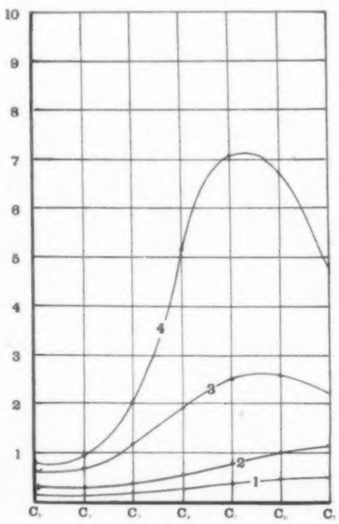


Fig. II.
Absorbing power: 1, West Point tile; 2, Pittsburgh tile; 3, acoustical tile; 4, best felt.

Even more interesting is the study of ceramic tile made at the request of Messrs. Cram, Goodhue, and Ferguson. The investigation had for its first object the determination of the acoustical value of the tile as employed in the groined arches of the Chapel of the United States Military Academy at West Point. The investigation then widened its scope, and, through the skill and great knowledge of ceramic processes of Mr. Raphael Guastavino, led to really remarkable results in the way of improved acoustical efficiency. The resulting construction has not only been approved by architects as equal, if not better, in architectural appearance to ordinary tile construction, but it is, so far as the writer knows, the first finished structural surface of large acoustical efficiency. Its random use does not, of course, guarantee good acoustical quality in an auditorium, for that depends on the amount used and the surface covered.

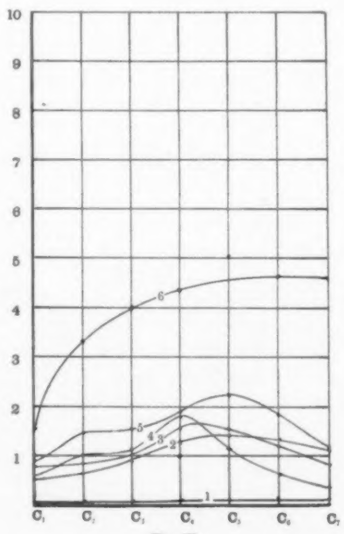


Fig. III.
Absorbing power: 1, bent wood chairs; 2, 3, 4, and 5, various kinds of pew cushions as described in text; 6, audience per person.

The first investigation was in regard to tile used at West Point, with the following result:

C_1, .012; C_2, .013; C_3, .018; C_4, .029; C_5, .040; C_6, .048; C_7, .053.

These are plotted in Curve 1, Fig. II. The first endeavors to improve the tile acoustically had very slight results, but such as they were they were incorporated in the tile of the ceiling of the First Baptist Church in Pittsburgh (Curve 2, Fig. II).

C_1, .028; C_2, .030; C_3, .038; C_4, .053; C_5, .080; C_6, .102; C_7, .114.

There was no expectation that the results of this would be more than a very slight amelioration of the difficulties which were to be expected in the church. In consequence of its use, the tile may be distinguished for purposes of tabulation as Pittsburgh tile. Without following the intermediate steps, it is sufficient to say that the experiments were continued nearly two years longer and ultimately led to a tile which for the conveniences of tabulation we will call Acoustical Tile. The resulting absorbent power is far beyond what was conceived to be possible at the beginning of the investigation, and makes the construction in which this tile is incorporated unique in acoustical value among rigid structures. The coefficients for this construction are as follows:

C_1, .064; C_2, .068; C_3 .117; C_4, .188; C_5, .250; C_6, .258; C_7, .223

graphically shown in Curve 3, Fig. II. It is not a panacea. There is, on the other hand, no question but that properly used it will very greatly ameliorate the acoustical difficulties when its employment is practicable, and used in proper locations and amounts will render the acoustics of many auditoriums excellent which would otherwise be intolerable. It has over sixfold the absorbing power of any existing masonry construction and one-third the absorbing power of the best known felt plotted on the same diagram for comparison (Curve 4). It is a new factor at the disposal of the architect.

Chairs and Audience.

Equally important with the wall and ceiling surfaces of an auditorium are its contents, especially the seats and the audience.

In expressing the coefficients of absorption for objects which are themselves units and which cannot be figured as areas, the coefficients depend on the system of measurement employed, Metric or English. While the international or metric system has become universal except in English-speaking countries, and even in England and America in many fields, it has not yet been adopted by the architectural profession and by the building trades, and therefore these coefficients will be given in both systems.

Ash settees or chairs, such as are ordinarily to be found in a college lecture room, have exceedingly small absorbing powers. Such furniture forms a very small factor in the acoustics of any auditorium in which it is employed. The coefficients for ash chairs are as follows (Curve 1, Fig. III):

Metric.

C_1, .014; C_2, .014; C_3, .015; C_4, .016; C_5, .017; C_6, .019; C_7, .021.

English.

C_1, .20; C_2, .20; C_3, .21; C_4, .23; C_5, .24; C_6, .27; C_7, .30.

The coefficients for settees were also determined, but differ so little from those for chairs that this paper will not be burdened with them. When, however, the seats are upholstered, they immediately become a considerable factor in the acoustics of an empty, or partially empty, auditorium. Of course the chairs either upholstered or unupholstered are not a factor in the acoustics of the auditorium when occupied. The absorbing power of cushions depends in considerable measure upon the nature of the covering and upon the nature of the padding. The cushions experimented upon were such as are employed in church pews, but the coefficients are expressed in terms of the cushion which would cover a single seat. The coefficients are as follows:

Cushions of wiry vegetable fiber covered with canvas and a thin damask cloth (Curve 2, Fig. III):

Metric.

C_1, .060; C_2, .070; C_3, .097; C_4, .135; C_5, .148; C_6, .132; C_7, .115.

English.

C_1, .87; C_2, 1.01; C_3, 1.40; C_4, 1.95; C_5, 2.13; C_6, 1.93; C_7, .166.

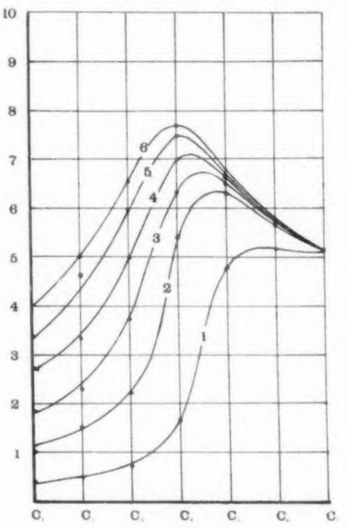


Fig. IV.

Absorbing power of felt of varying thickness, from one-half to three inches, showing by extrapolation the absorption by thin fabrics of the upper register only.

Cushions of long hair covered with canvas and with an outer covering of plush (Curve 3, Fig. III):

Metric.

C_1, .080; C_2, .092; C_3, .105; C_4, .165; C_5, .155; C_6, .128; C_7, .085.

English.

C_1, 1.15; C_2, 1.32; C_3, 1.52; C_4, .238; C_5, .224; C_6, .185; C_7, .123.

Cushions of hair covered with canvas and an outer covering of thin leatherette (Curve 4, Fig. III):

Metric.

C_1, .062; C_2, .105; C_3, .118; C_4, .180; C_5, .118; C_6, .068; C_7, .040.

English.

C_1, .90; C_2, 1.52; C_3, 1.70; C_4, 2.60; C_5, 1.70; C_6, .98; C_7, .58.

Elastic felt cushions of commerce, elastic cotton covered with canvas and a short nap plush (Curve 5, Fig. III):

Metric.

C_1, .092; C_2, .155; C_3, .175; C_4, .190; C_5, .258; C_6, .182; C_7, .120.

English.

C_1, 1.32; C_2, 2.24; C_3, 2.53; C_4, 2.74; C_5, 3.71; C_6, 2.62; C_7, 1.73.

Of all the coefficients of absorption, obviously the most difficult to determine are those for the audience itself. It would not at all serve to experiment on single persons and to assume that when a number are seated together, side by side, and in front of one another, the absorbing power is the same. It is necessary to make the experiment on a full audience, and to conduct such an experiment requires the nearly perfect silence of several hundred persons, the least noise on the part of one vitiating the observation. That the experiment was ultimately successful beyond all expectation is due to the remarkable silence maintained by a large Cambridge audience that volunteered itself for the purpose, not merely once, but on four separate occasions. The coefficients of absorption thus determined lie, with but a single exception, on a smooth curve (Curve 6, Fig. III). The single exception was occasioned by the sound of a distant street car. Correcting this observation to the curve, the coefficients for an audience per person are as follows:

Metric.

C_1, .160; C_2, .332; C_3, .395; C_4, .440; C_5, .455; C_6, .460; C_7, .460.

English.

C_1, 2.30; C_2, 4.80; C_3, 5.70; C_4, 6.34; C_5, 6.55; C_6, 6.60; C_7, 6 60.

Fabrics.

It is evident from the above discussion that fabrics are high absorbents of sound. How effective any particular fabric may be, depends not merely on the texture of its surface and the material, but upon the weave or felting throughout its body, and of course also upon its thickness. An illuminating study of this question can be made by means of the curves in Fig. IV. In this figure are plotted the coefficients of absorption for varying thicknesses of felt. Curve 1 is the absorption curve for felt of one-half inch thickness, Curve 2 of felt of one inch thickness, and so on up to Curve 6, which is for felt of three inches in thickness. It is interesting to contemplate what the result of the process would be were it continued to greater thickness, or in the opposite direction to felt of less and less thickness. It is inconceivable that felt should be used more than three inches in thickness and therefore extrapolation in this direction is of academic interest only. On the other hand, felt with decreasing thickness corresponds more and more to ordinary fabrics. If this process were carried to an extreme, it would show the effect of cheesecloth or bunting as a factor in the acoustics of an auditorium. It is obvious that very thin fabrics absorb only the highest notes and are negligible factors in the range of either the speaking voice or of music. On the other hand, it is evident that great thickness of felt absorbs the lower register without increasing whatever its absorption for the upper register. Sometimes it is desirable to absorb the lower register, sometimes the upper register, but far more often it is desirable to absorb the sounds from C_3 to C_6, but especially in the octave between C_4 and C_5.

The felt used in these experiments was of a durable nature and largely composed of jute. Because wool felt and ordinary hair felt are subject to rapid deterioration from moths, this jute felt was the only one which could be recommended for the correction of auditoriums until an interested participator in these investigations developed an especially prepared hair felt, which is less expensive than jute felt, but which is much more absorbent. Its absorption curve is plotted in Fig. II.

Location.

Such a discussion as this should not close without pointing out the triple relation between pitch, location, and apparent power of absorption. This is shown in Fig. V. Curve 1 shows the true coefficient of absorption of an especially effective felt. Curve 2 is its apparent absorption when placed in a position which is one of loudness for the lower register and of relative silence for the upper register. Curve 3 is the apparent coefficient of absorption of the same felt when placed in a position in the room of maximum loudness for all registers. It is evident from these three curves that in one position a felt may lose thirty per cent and over of its efficiency in the most significant register, or may have its efficiency nearly doubled. These curves relate to the efficiency of the felt in its effect on general reverberation. Its efficiency in the reduction of a discrete echo is dependent to an even greater degree on its location than on pitch.

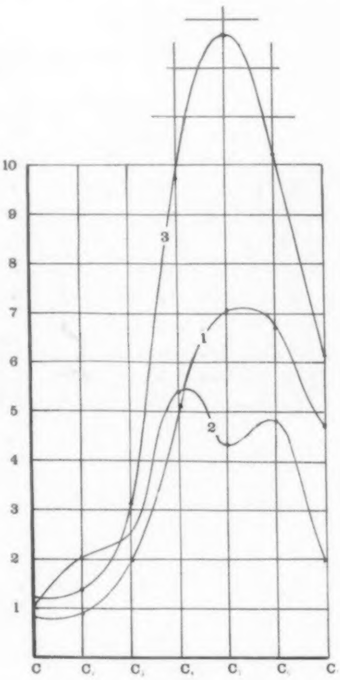


Fig. V.

Double dependence of absorbing power on pitch and on location, showing one of the sources of error which must be guarded against in the determination of coefficients of absorption and in the use of absorbing materials.

The above are the coefficients of absorption for most materials usually occurring in auditorium construction, but there are certain omissions which it is highly desirable to supply, particularly noticeable among these is the absorption curve for glass and for old plaster. It is necessary for such experiments that rooms practically free from furniture should be available and that the walls and ceiling of the room should be composed in a large measure of the material to be tested. The author would appreciate any opportunity to carry out such experiments. The opportunity would ordinarily occur in the construction of a new building or in the remodeling of an old one.

It may be not wholly out of place to point out another modern acoustical difficulty and to seek opportunities for securing the necessary data for its solution. Coincident with the increased use of reinforced concrete construction and some other building forms there has come increased complaint of the transmission of sound from room to room, either through the walls or through the floors. Whether the present general complaint is due to new materials and new methods of construction, or to a greater sensitiveness to unnecessary noise, or whether it is due to greater sources of disturbance, heavier traffic, heavier cars and wagons, elevators, and elevator doors, where elevators were not used before — whatever the cause of the annoyance there is urgent need of its abatement in so far as it is structurally possible. Moreover, several buildings have shown that not infrequently elaborate precautions have resulted disastrously, sometimes fundamentally, sometimes through the oversight of details which to casual consideration seem of minor importance. Here, as in the acoustics of auditoriums, the conditions are so complicated that only a systematic and accurately quantitative investigation will yield safe conclusions. Some headway, perhaps half a year's work, little more than a beginning, was made in this investigation some years ago. Methods of measurements were developed and some results were obtained. Within the past month the use of a room in a new building, together with that of the room immediately below it, has been secured for the period of two years. Between these rooms the floor will be laid in reinforced concrete of two thicknesses, five inches and ten inches, in hollow tile, in brick arch, in mill construction, and with hung ceiling, and the transmission of sound tested in each case. The upper surface of the floor will be laid in tile, in hardwood, with and without sound deadening lining, and covered with linoleum and cork, and its noise to the tread measured.

However, such experiments but lay the foundation. What is needed are tests of the walls and floors of rooms of various sizes, and of the more varied construction which occurs in practice, in rooms connecting with offsets and different floor levels — the complicated conditions of actual building as against the simplified conditions of an orderly experiment. The one will give numerical coefficients, the other, if in sufficiently full measure, will give experience leading to generalization which may be so formulated as to be of wide value. What is therefore sought is the opportunity to experiment in rooms of varied but accurately known construction, especially where the insulation has been successful. Unfortunately with modern building materials acoustical difficulties of all sorts are very numerous.

Design Submitted for The Lincoln Memorial, Washington, D. C., by John Russell Pope, Architect.
Otto R. Eggers, Delineator.

Monographs on Architectural Renderers.

BEING A SERIES OF ARTICLES ON THE ARCHITECTURAL RENDERERS OF TO-DAY, ACCOMPANIED BY CHARACTERISTIC EXAMPLES OF THEIR WORK.

I. THE WORK OF OTTO R. EGGERS.

IN presenting the work of Mr. Eggers as the first of a series on American rendering, one feels that a peculiarly excellent choice has been made, for the two reasons, that Mr. Eggers is primarily a designer and not a specialist in rendering, and that the work presents so beautiful a blend of pictorial and architectural effects. Architectural rendering has of late years become more or less of a specialty, and the men who make the exhibition drawings and the color renderings for submission to clients have in the main become a specialized class, which does nothing else, and their ranks are recruited mainly from the architects' offices, but with occasional accessions from the painters. In the old days the perspective drawing (it was not then called a rendering) was almost invariably made in the office of the architect, or often by the architect of the building it depicted, and these old renderings, though oftentimes crude and unintelligent, were perhaps more interesting than the beautiful drawings of the present day because they were personal documents of the designers. This older method gave of course a certain advantage in the securing of work to the architect of pictorial talent— an advantage perhaps undeserved since the picture is not the ultimate aim of the architect. The professional renderer was developed to overcome this disadvantage.

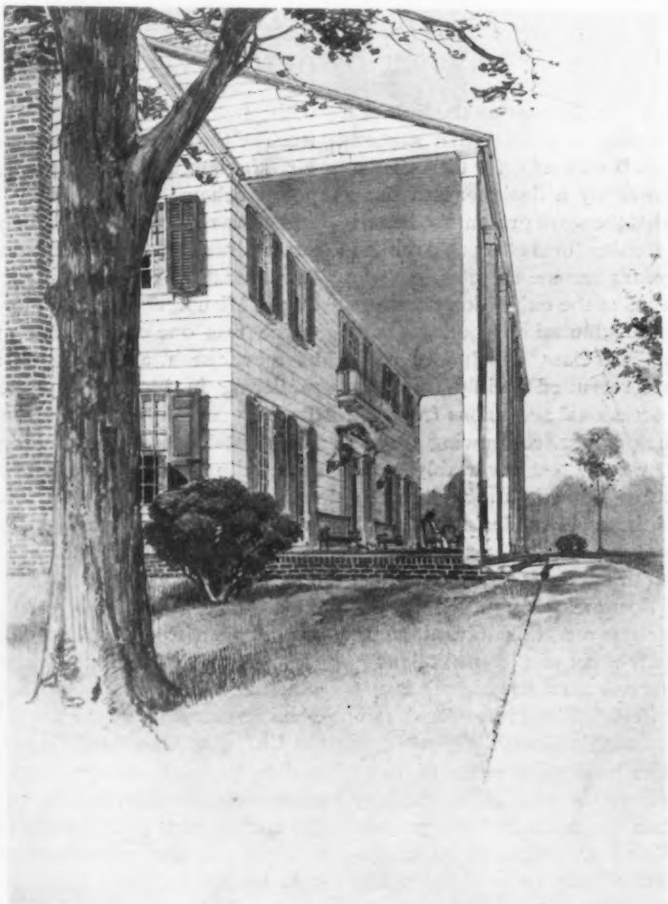
The fact that it is now the habitual practice of most offices, even of large size, to have their rendering done by men outside of the offices, does not mean that the proportion of men among the practising architects, or of draftsmen in their offices who have ability in rendering, has decreased: in fact, the contrary is the case, and not only is there a larger proportion of men who are able to render with some approach to architectural skill, but also the work of these men is of a better grade than it used to be. Mr. Magonigle, for example, made a drawing for his proposed scheme for the Perry Memorial some years ago, which was quite as beautiful a thing as Mr. Long's wonderful drawing of the Hudson Fulton Competition. Mr. Seymour made a rendering of the winning scheme of the Perry Memorial (Friedlander and Seymour, architects), which was one of the best architectural renderings we have ever seen, and although it was a truly architectural rendering in black and white, it still was the type of drawing which could be submitted to a client. Mr. Hornbostel's facility with his pencil is as famous as it is extraordinary, and there is no one perhaps among the men whose business it is to render, who could so wonderfully indicate metal work and besides give the effect of distance, as Mr. Hornbostel has done in his bridge drawings. Mr. Pope, in his student days, and in the course of the earlier years of his practice, made some very lovely colored sketches; Mr. Cass Gilbert has often been represented in the exhibitions by his water-color travel sketches, which he continues to make even at the present day, and when he occasionally does make a rendering, as he did of the Chapel at Oberlin College some years ago, we at once realize that its author was no amateur; Mr. Platt of course was a painter before he became an architect, and has continued to paint to the present time; and while one cannot recall any particular architectural drawings of his, it is highly probable that he has made them and still could. These are but a few examples of practising architects who are called to mind; there are unquestionably as

many more in New York, Chicago, and elsewhere of equal ability with those mentioned, as well as a very great number who are perfectly capable of making a drawing which would pass muster in any exhibition ; for example, as Lindeberg, Kiessling, LeBoutillier, Spencer, Wright, and Embury. Beside these men there are again a very great number who are known by the work of their offices rather than by their personal design, whose rendering is extremely familiar, such men, for example, as T. R. Johnson, John Almy Tompkins II, W. T. L. Armstrong, A. M. Githens, André Smith, and others who do make occasional renderings for outside architects, although most of their time is devoted to work in their own offices. From this latter list of names some have been selected for later articles in this series. Fifteen years ago, however, there was not such a crowd of talented names which instantly came to mind, either among the architects themselves or among the professional renderers. In the East Mr. Hughson Hawley had developed a style which was admirably adapted to catch the public eye, and was followed by a host of imitators. Other men of original force, notably Mr. Birch Burdette Long as an independent renderer, and Mr. Wilson Eyre in renderings of his own work, struck an original note which also created followings, but when Eggers' work first began to be shown to the architectural public, it realized that a man had arrived who was an imitator of no one of the three. His work had neither the transparent delicacy of Long's renderings nor the careless force of Mr. Eyre's. If there were any one that he followed, it was rather Jules Guerin. His art, however, was far more architectural than that of Guerin, who after all is an impressionist among renderers, and resembles Long's to the extent that he thoroughly understands architecture and is not afraid to work up detail, although subordinating it to the general color scheme.

Mechanically his greatest innovation was in the use of the air brush, with which he secured the lovely vibrant quality of his skies, and not infrequently a large part of his painting was done in this manner with the details reinforced by the judicious use of pencil, charcoal, Chinese white or color applied in the usual way, as the case seemed to demand. His color schemes have usually been strong ones, brilliantly blue skies with a warm yellow lighting of the buildings, and in the architectural exhibitions they are inevitably placed at focal points, since they are far stronger and richer than most of the colored drawings which are hung ; but they are very rarely crude or garish in spite of the high key of his palette. There has been scarcely an exhibition, in New York at least, for the last half dozen years, which has not contained one or two examples of Mr. Eggers' art. The number has been limited, however, because of the fact above stated that Mr. Eggers is not a specialist in rendering, but is primarily a designer, and has been almost continuously employed in one or another of the New York offices since he began his work. It was as a member of one or the other of these offices that his most beautiful rendering has been done ; for Tracy and Swartwout, for example, two magnificent drawings of the armory and Denver Post Office, and one of the Denver cathedral ; while for John Russell Pope, where he now is and has been for the past few years, he made the drawings of Mr. Pope's scheme for the Lincoln Memorial, two of which are illustrated in this issue (see Frontispiece), as well as that of the Masonic Temple at Washington. No black and white reproductions can do justice to their charm, although they will serve to illustrate the varied character of his work, for he has not confined himself to the medium which he has made peculiarly his own, but is also equally facile in the use of pencil, relieved by flat washes, somewhat after Mr. Gregg's manner, and in pen drawing. In fact some of the most beautiful things that he has ever done have been in pen and ink for frontispieces, book plates, headings, and the like, for which his inspiration has evidently been drawn from the Renaissance etchers and engravers, with a certain leaning toward Piranesi.

Particular attention is called to Mr. Eggers' design and rendering for the new contents page of THE BRICKBVILDER, as an example of his pen and ink work.

There is one point in Mr. Eggers' career which is of notable interest — his style was self-evolved. He had, it is true, some school training both at the Art Students' League in New York and in the ateliers of the Society of Beaux Arts architects, but his period of



House at Wickatunk, N. J. John Russell Pope, Architect.
Otto R. Eggers, Delineator.

U. S. Post Office, Denver, Colo. Tracy & Swartwout, Architects.
Otto R. Eggers, Delineator.

study at the Art Students' League was brief, and in the ateliers he was rather a teacher than a student, far advanced beyond the majority of his colleagues, and even of the men in charge of the ateliers in the use and management of color.

One does not find that very many men eminent in their own lines have ever been for a long time students in the sense that they were being taught by some one. In the true sense of the word, Mr. Eggers has always been a student, and probably always will continue to be, since he has carefully studied all art work from the time when he was a boy, and has drawn from all sorts of sources the elements which he has incorporated and made his own. If fault is to be found with his work, it is rather in the direction of over carefulness and of carrying a rendering too far, which is perhaps the last thing one finds to complain of in the present age of haste, and even when this happens as it does in some of his drawings, the picture never falls to pieces into a series of unrelated details, but only becomes a little hard and liney. His services are of course eagerly sought by men who have competitions to render, or hope to obtain a big commission through the presentation of a beautiful drawing, and it is a matter of general regret to the profession that his work does not permit of his giving much time to things outside the office, although it is perhaps best that the artistic side of his capabilities should not be extended too far at the expense of his professional side; and it is good to note that Mr. Pope, himself able to make an excellent rendering, as well as being a great architect, leans almost as heavily on Mr. Eggers' exquisite taste and skill in design as he does upon his ability to make an attractive rendering.

House at Scarsdale, N. Y. Parker Morse Hooper, Architect.
Otto R. Eggers, Delineator.

The Lighting of Public and Semi-Public Buildings.

FIFTH PAPER.

ACCOMPANIED BY A SERIES OF ILLUSTRATIONS SHOWING SPECIFIC LIGHTING INSTALLATIONS.

By L. B. MARKS.
Consulting Illuminating Engineer, New York City.

HOTELS AND CLUBS.

IN the lighting of hotels the lobby, reception room, and dining and banquet rooms usually receive most attention.

The tendency has been to carry the scale of illumination in these rooms, especially in the lobby, far beyond the needs of good lighting, and to bedeck the ceiling, walls, and columns with brilliant lamps. Fortunately, improvement in the efficiency of lamps, both electric and gas, is now leading to the more extended use of diffusing glassware to cover the lamps and soften the light. Semi-indirect lighting and indirect lighting, either alone or supplemented by direct lighting, are being used to a much greater extent than heretofore. A very happy combination of lighting units results from the provision of a moderate intensity of general illumination by indirect or semi-indirect lighting and a higher intensity of local illumination produced by table lamps, brackets, or floor standards. Such an arrangement also lends itself well to the attainment of desirable color effects.

In Fig. XXXIX is shown the method of lighting the Palm Room (dining hall) of the Bellevue-Stratford Hotel, Philadelphia. The illumination is carried out by indirect lighting from the ceiling coves, supplemented by candelabra on tall uprights. The lights on the candelabra are shaded by brown silk shades which give a tinted, mellow light, the color of which harmonizes with the room decorations. This arrangement serves the double purpose of relieving any impression of "coldness" that may be due to the use of indirect lighting alone and affording a means of rest to the eye by virtue of the color difference.

The average ceiling height in this room is twenty-one feet; the finish of the ceiling is cream-white, broken by a very pleasing series of paintings appropriate to the surroundings. The cove lighting system permits of the effectual display of the paintings. The side walls are finished in terra cotta buff, and the chairs in old gold with green velour upholstering.

The current consumption was a secondary consideration on the part of the owners of the hotel, who sought first of all a lighting scheme which would lend itself to the decorative effect desired. The intensity of illumination on the tables averages 2.0 foot-candles, with a minimum of 1.6 and a maximum of 2.6. The power required for the indirect cove lighting, in which tubular tungsten lamps are used, is three watts per square foot.

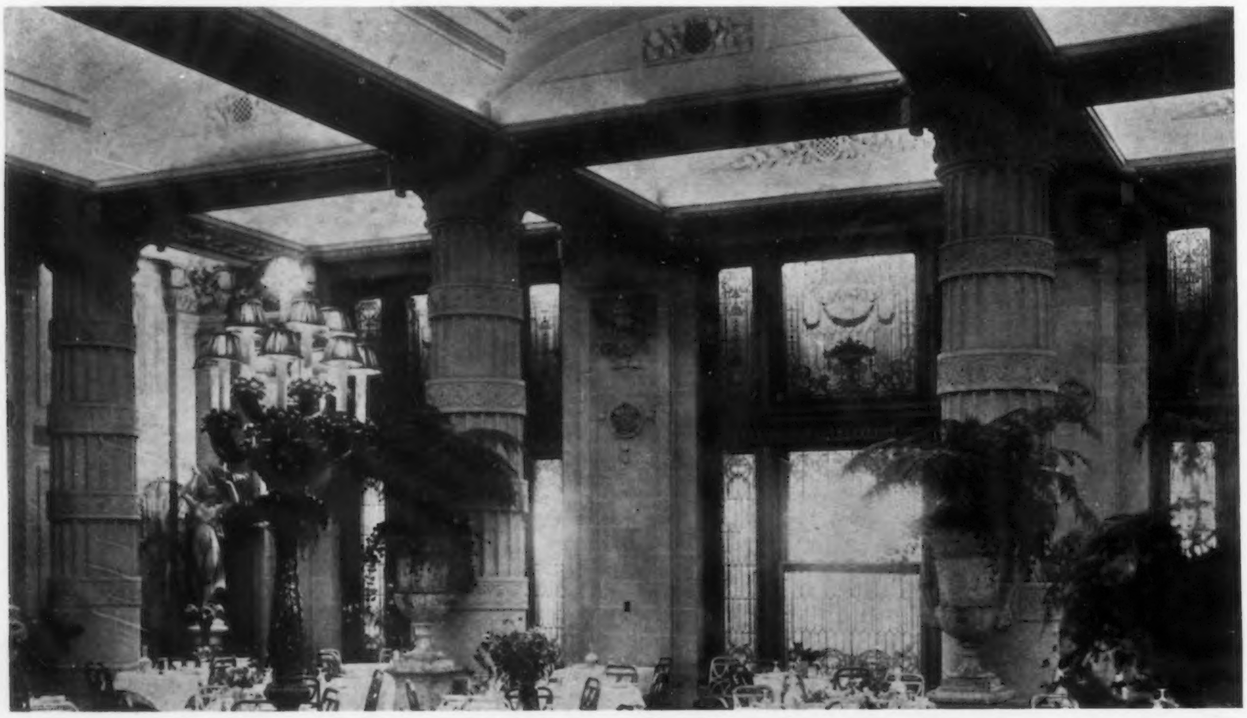


Fig. XXXIX. Palm Room (dining hall), Bellevue-Stratford Hotel, Philadelphia, showing indirect lighting from ceiling coves, supplemented by direct lighting from candelabra on tall floor standards.

Fig. XL. Transportation Club, New York City.

Fig. XLI. Reception Room, Transportation Club, Denver, Colo.

Examples of Semi-indirect Lighting with Lamps Enclosed in Diffusing Glass Globes.

THE illustrations above show the semi-indirect bowl lighting fixtures in the dining room of the Transportation Club, New York City, and the reception room of the Transportation Club, Denver. The important point in semi-indirect lighting is to use bowls of relatively low brightness, as otherwise the glare of the bowl is apt to be trying to the eyes.

The illustration at the right shows a gas light illumination. Forty-five degree angle shades pointed towards the walls are used on reflex gas burners. The general illumination of the room is derived mainly from light reflected from the walls and ceiling.

Fig. XLII. Gas lighting installation at the Philadelphia Art Club.

Fig. XLIII. Ball Room of the South Shore Country Club, Chicago, showing large indirect lighting fixtures.

Ceiling Height .... *28 ft.*
Dimensions .... *62 x 100 = 6,200 sq. ft.*
Outlets ..... *3* *Watts* ..... *6,900 Watts per square foot, 1.1*
Average Foot-candles *2.8*
Ceiling Tint .... *Ivory*
Wall Tint .... *Dark Red Panels on Side Walls*
Distance to Ceiling .... *60 ins.*

(NOTE.—Each fixture contains 23 100-watt lamps. The promenade on the side is also lighted by indirect lighting.)

Fig. XLIV. Drawing Room, Whitehall Club, New York City, illuminated by tungsten lamps in opaque (indirect lighting) fixtures.

Ceiling Height .... *14 ft. 9 ins.*
Dimensions .... *50 x 66 = 3,300 sq. ft.*
Outlets ..... *9* *Fixture* ..... *6 100-Watt Lamps per Fixture*
Watts .... *Total, 5,400. Watts per square foot, 1.63*
Average Foot-candles *4.25*
Ceiling Tint .... *Ivory*
Wall Tint .... *Dark Woodwork*
Distance to Ceiling .... *36 ins.*

Fig. XLV. Indirect lighting fixtures, Grecian Marble Café, Blackstone Hotel, Chicago.

Fig. XLVI. Lobby of Auditorium Hotel, Chicago, showing indirect lighting fixtures.

The following data apply to Fig. XLV:

Ceiling Height .... *16 ft.*
Dimensions .... *47 x 50 = 2,350 sq. ft.*
Outlets ... *6 (20 40-watt lamps per fixture)*
Watts. Total, 4,800. Watts per sq. ft., 2.05
Average Foot-candles *4.0*
Ceiling Tint .... *Ivory White*
Distance to Ceiling .... *4 ft.*

The following data apply to Fig. XLVI:

Ceiling Height .... *24 ft.*
Dimensions .... *48 x 96 = 4,608 sq. ft.*
Outlets .. *12 (5 100-watt lamps per fixture)*
Fixture .... *Special*
Watts. Total, 6,000. Watts per sq. ft., 1.3
Average Foot-candles *3.50*
Ceiling and Wall Tint .... *Ivory White*
Distance to Ceiling .... *5 ft. 4 ins.*

(NOTE — Size of bay, 16 ft. x 24 ft. Indirect lighting also used in parlor on second floor, Masonic Lodge, and barber shop in this building.)

WITH the type of chain system used in the San Antonio Hotel shown in the illustration below there are no ceiling shadows such as frequently occur when using a short fixture suspended by several chains hung from a ceiling canopy. The lamps in these diffusing bowl fixtures project horizontally inward from the bolts in the rim of the bowl.

FIG. XLVIII shows a rather unique method of lighting by the indirect method of illumination. The lighting is carried out exclusively by lamps mounted on floor pedestals. Inside of the large shade at the top of each of these pedestals is mounted a 250-watt tungsten lamp centrally located and pointed towards the ceiling. A silvered mirror reflector which surrounds the lamp, except at its lower portion, directs most of the light to the ceiling through the open top of the shade. The illumination of the room is thus carried out mainly by light reflected from the ceiling. A portion of the light from the lamp is permitted to escape downward and sideward to light up the art shade. A stronger downward direction of the light and a greater transmission through the art shade may be accomplished by supplemental lamps mounted inside of the shade.

Fig. XLVII. Semi-indirect lighting in Dining Room, San Antonio Hotel, Texas.

This scheme permits of a combination of direct and indirect lighting elastic enough to produce lighting effects of widely different character to suit the needs of different rooms. It has the further advantage of providing color tone to the illumination and of completely screening the lamps themselves.

The following data apply to the above installation :

Interior..........*Tea Room*
Place..Hyde Park Hotel City..Chicago
Ceiling Height..........*12 ft.*
Dimensions..........*56 x 23 = 1,288 sq. ft.*
Fixture..........*Floor Pedestal*
Watts, 2,000..........*Watts per sq. ft., 1.55*
Average Foot-candles..........*3.5*
Ceiling Tint..........*Light Gray*
Wall Tint..........*Light Pink*
Distance to Ceiling..........*5 ft. 10 ins.*
(NOTE. — Each pedestal contains 1 250-watt tungsten lamp.)

Fig. XLVIII. Night view of the Tea Room, Hyde Park Hotel, Chicago, showing combined indirect and direct lighting in a standing lamp.

THE three lighting fixtures shown at the right are adaptable for various forms of indirect and semi-indirect lighting. Fig. XLIX shows a lighting standard (Three Graces) supporting an urn in which the lamps are housed. The urn may be opaque as in indirect lighting or translucent as in semi-indirect lighting. This type of standard is well adapted for either electric or gas light, and has been very effectively used in hotels and clubs. A decorative bowl fixture with chain suspension, in which a single large lamp furnishes the light, is shown in Fig. L. This type of fixture has found favor in hotels and clubs and can be advantageously used either in semi-indirect or in totally indirect lighting. Fig. LI is designed in Louis XV style and used mainly for indirect lighting.

The following data apply to Fig. LII :

Ceiling Height, 20 ft. Dimensions, 38 x 95 ft.
Outlets....8 Fixture....Floor Pedestal
Watts, 8,000..........*Watts per sq. ft., 2.22*
Average Foot-candles..........*5.0*
Ceiling and Wall Tint..........*Ivory White*
Distance to Ceiling..........*12 ft. 6 ins.*
(NOTE.—Pedestals stand about 7 ft. 6 ins. from floor. Old rose carpets and curtains. Bracket lamps not used.)

Fig. XLIX.

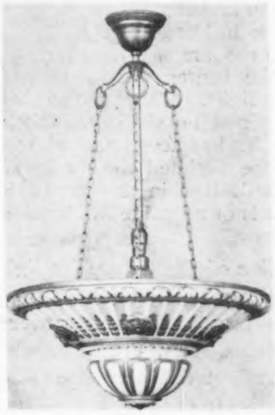


Fig. L.

Fig. LI.

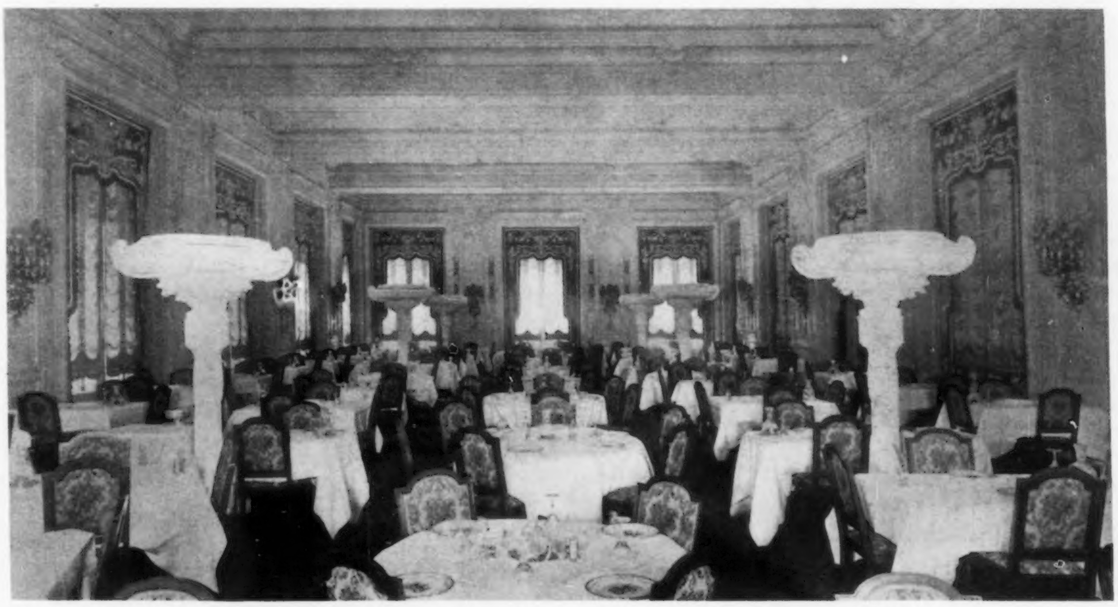


Fig. LII. Louis XVI. Dining Room, Congress Hotel, Chicago, showing floor pedestals with tungsten lamps for indirect illumination.

HOSPITALS.

THE operating room and the hospital ward are perhaps the two most important portions of the building from a lighting standpoint. The general principles of illumination, as hereinbefore discussed, cover the fundamental requirements of a lighting installation designed to meet this service, but special requirements, as in the operating room, render the lighting of such a room a problem apart from most others.

Dr. W. M. L. Coplin, of Philadelphia, in a paper on the subject of hospital lighting,* thus describes the lighting of a typical operating room:

> The walls are white; the side light and the skylight are fitted with diffusing glasses. In other words, an attempt has been made to adapt the photographer's method to the lighting of an operating room. The lighting fixture is made of steel with the lamps arranged radially around the center, and with one central pendent light. There are no shadows in the room; the table legs cast no shadow. Often the lighting engineer considers he has accomplished what is necessary in lighting if he has obviated the shadows, but still it is far short of what is desired in the way of lighting. As arranged, the light is of no value in illuminating the intestines of a patient.

Commenting on the location of the fixture for lighting the operating table, Dr. Coplin calls attention to the fact that this fixture should not be placed directly over the operating table as in most hospitals, even though the fixture be provided with the best diffusing glass shades. He favors having the light come from the side or sides,— a direction which not only usually results in more effective lighting, but also in avoiding the shadows caused by the interposition of the hand or body of the operator, between the light and the patient. Mr. W. S. Kilmer who has made a careful study of the illumination requirements in hospitals recommends that available intensity on operating table be not less than 25 foot-candles and that the quality approximate daylight. In some of the foreign hospitals the problem of securing a directed light from either one direction or simultaneously from several directions, has been solved by locating a series of mirrors above and at the sides of the operating table and reflecting a powerful beam of light to the table from each of these mirrors.

*Trans. Illum. Eng. Soc., Jan., 1912.

Fig. LIII. Night view of Hospital Ward, illuminated by general indirect and local direct lighting.

SUPPLEMENTING the indirect ceiling units are wall brackets at the head of each bed. Such brackets, if used, should be provided with opaque shades to shield the eyes of the occupants of opposite beds. Indirect lighting when used for this purpose should be designed for a low intensity of illumination, as otherwise the brightly lighted ceiling would be objectionable to patients lying in bed.

RAILWAY TERMINALS.

FIG. LIV represents a night view of the waiting room of the Union Station, Washington, D. C., showing indirect illumination by concealed arc lamps. This station, including the concourse and train sheds, covers more than eighteen acres of ground space. The following description of the system of illumination in the main waiting room, and the data of illumination tests in this room, are given by Mr. W. D'A. Ryan:

The architectural features of the waiting room called for concealed lighting from the ceiling or for indirect lighting. The latter system was decided on, use being made of the alcoves on either side and ends of the room. The lighting units consist of inverted series arc lamps placed on top of the colonnades back of the balustrade. The lamps are placed in especially constructed boxes with corrugated mirrors, the whole arrangement so designed to throw the light on the barrel shaped ceiling which is approximately one hundred feet from the floor. Cathedral glass screens were placed in the path of the rays to soften the light. The use of these screens entailed a loss of about fifteen per cent of light.

The following are the data of illumination tests in the main waiting room:

Dimensions of room	210 x 120 ft.
Area of room	25,200 sq. ft.
Height of lamps	25 ft.
Height to center of arch	95 ft.
Cubic feet	2,072,000
Energy:	
14 arc lamps per bay (10 bays)	140
Ends east	14
Ends west	4
Total arc lamps	158

Total kilowatts . . . 75.9
Watts per sq. ft. . . . 3.01
Watts per cubic ft. 0366

Intensity of illumination on horizontal plane along major axis of room . . 1.1 to 2.0 foot-candles

Along minor axis . . . 1.0 to 1.7 foot-candles

Direct current 6.6 ampere series lamps with special reflector.

Fig. LIV. Night view of Main Waiting Room, Union Station, Washington, D. C., showing indirect illumination by concealed arc lamps.

The lighting of the waiting room of this terminal is in striking contrast to the lighting in the new Grand Central terminal, N.Y. City, in which exposed lamps are used practically throughout.

DETAIL OF ENTRANCE FRONT

HOUSE AT WASHINGTON, D. C.

JOHN RUSSELL POPE, ARCHITECT

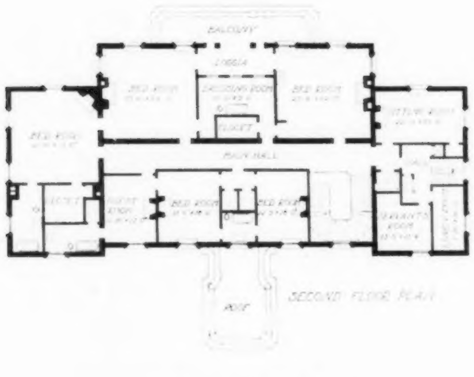
VIEW FROM APPROACH

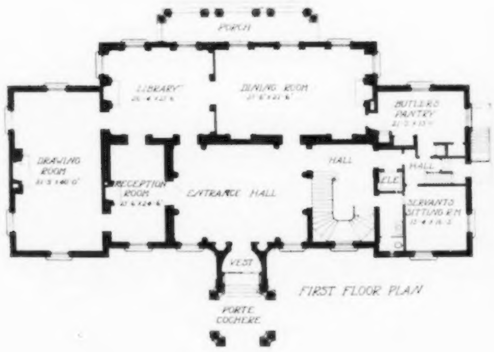
VIEW OF TERRACE FRONT

HOUSE AT WASHINGTON, D. C.

JOHN RUSSELL POPE, ARCHITECT

VIEW OF SOUTH PORCH AND TERRACE

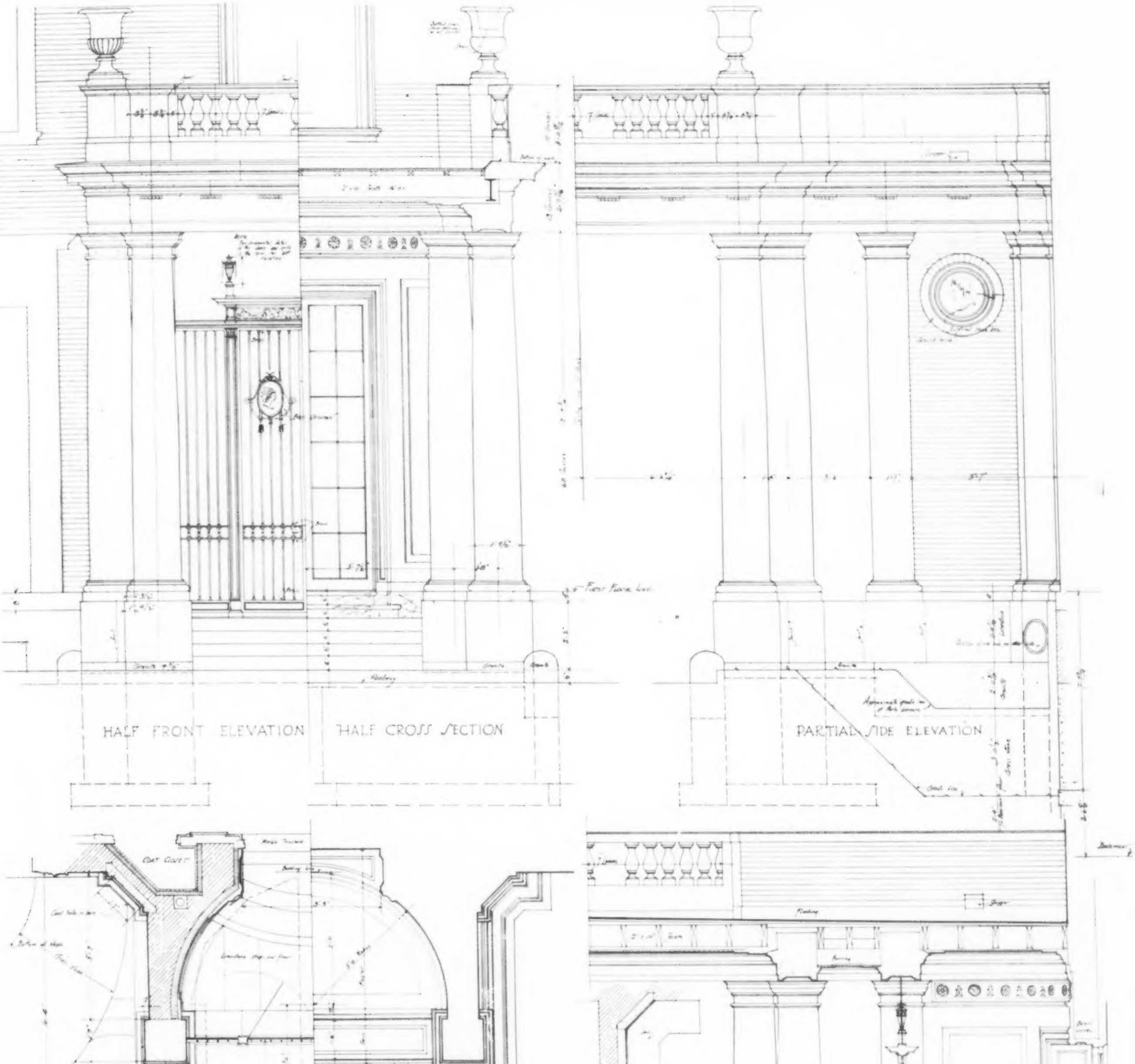




DETAIL LOOKING TOWARD GARDEN

HOUSE AT WASHINGTON, D. C.

JOHN RUSSELL POPE, ARCHITECT



DETAIL OF PORTE COCHERE

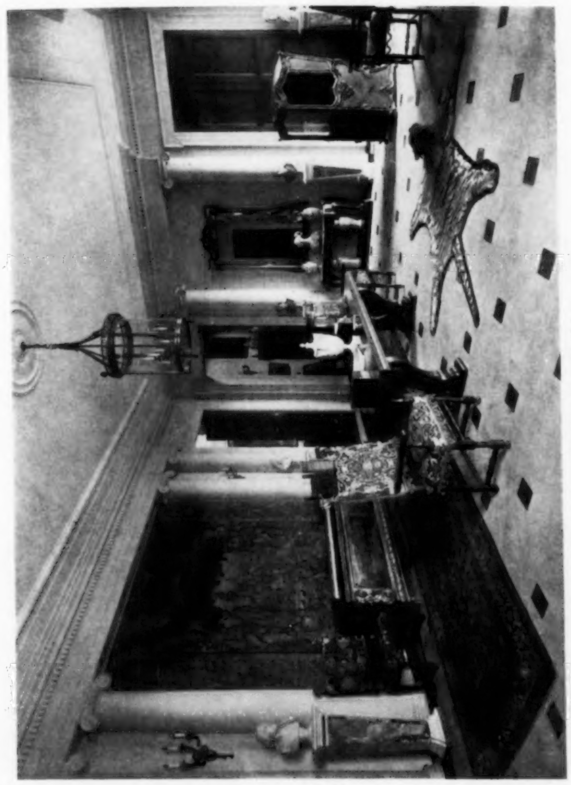
HOUSE AT WASHINGTON, D. C.

JOHN RUSSELL POPE, ARCHITECT

DINING ROOM

LIBRARY

HOUSE AT WASHINGTON, D. C.
JOHN RUSSELL POPE, ARCHITECT



ENTRANCE HALL

CORNER OF ENTRANCE HALL

STAIR HALL

HOUSE AT WASHINGTON, D. C.

JOHN RUSSELL POPE, ARCHITECT

GUILFORD PUBLIC SCHOOL, CINCINNATI, OHIO
GARBER & WOODWARD, ARCHITECTS

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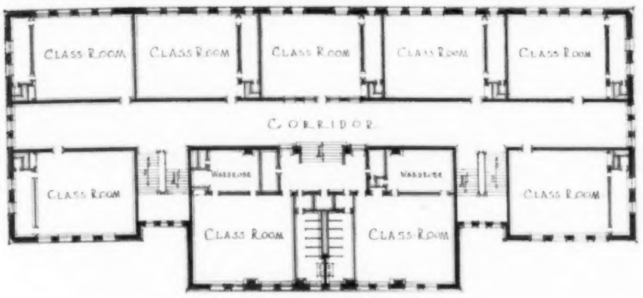
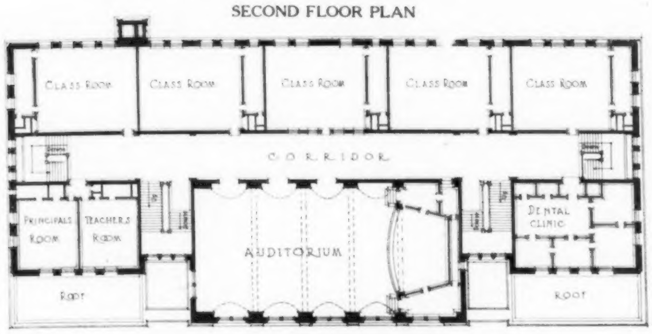
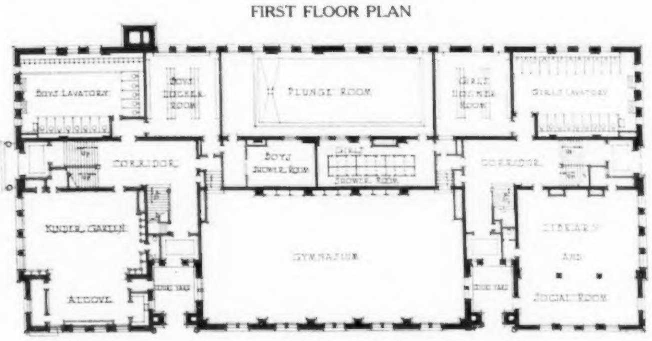


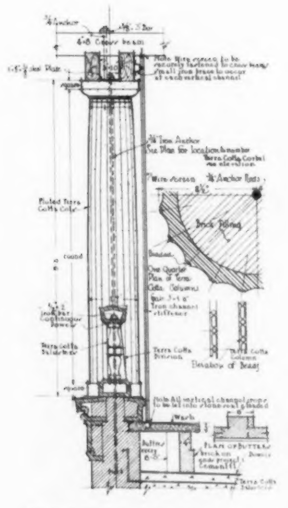
SECOND FLOOR PLAN



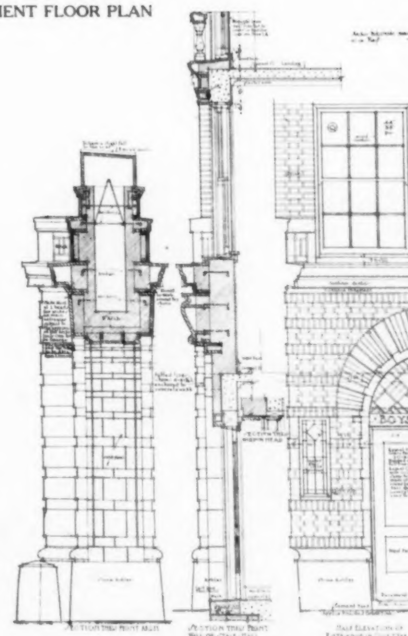
FIRST FLOOR PLAN

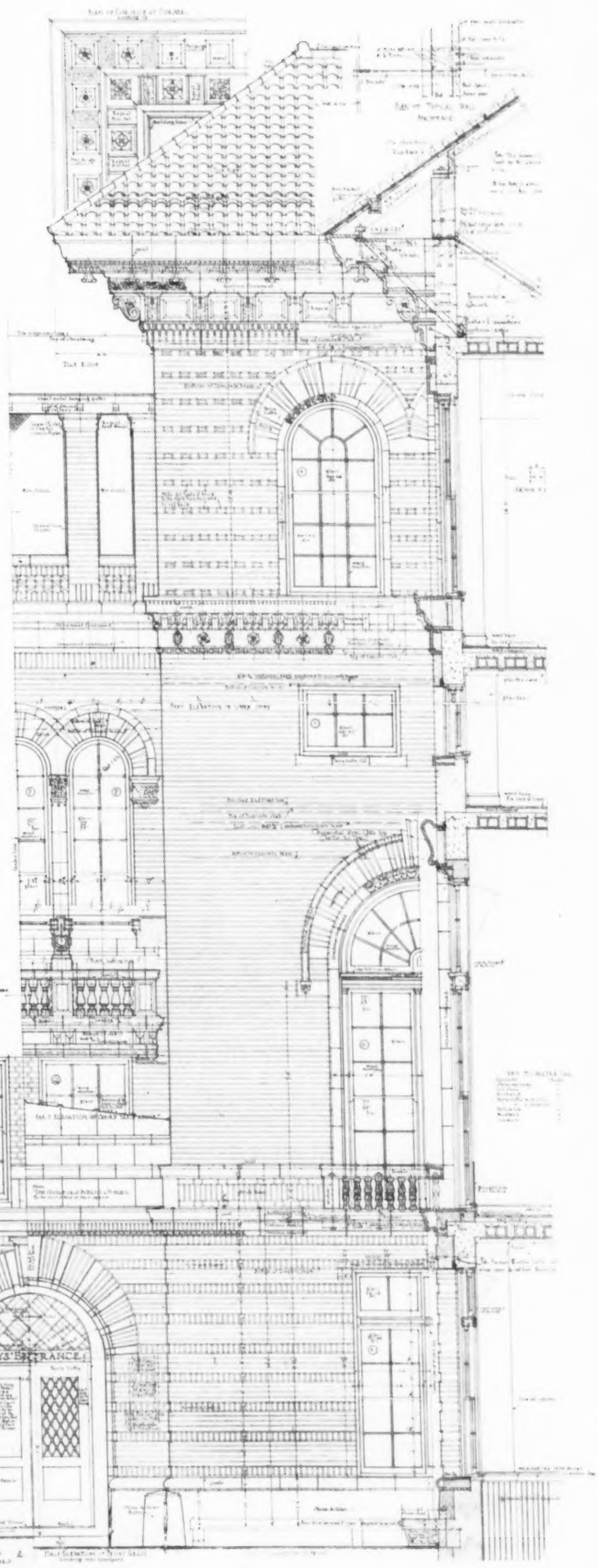


BASEMENT FLOOR PLAN



DETAIL OF COLUMN AND BALUSTER

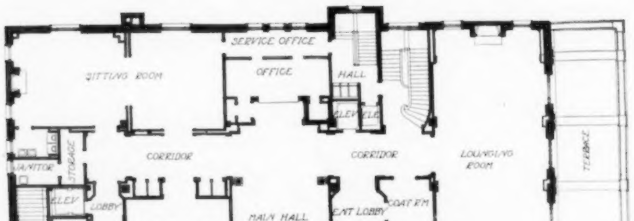




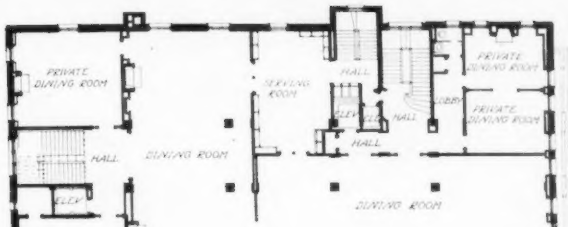
DETAIL OF MAIN ELEVATION

GUILFORD PUBLIC SCHOOL, CINCINNATI, OHIO

GARBER & WOODWARD, ARCHITECTS



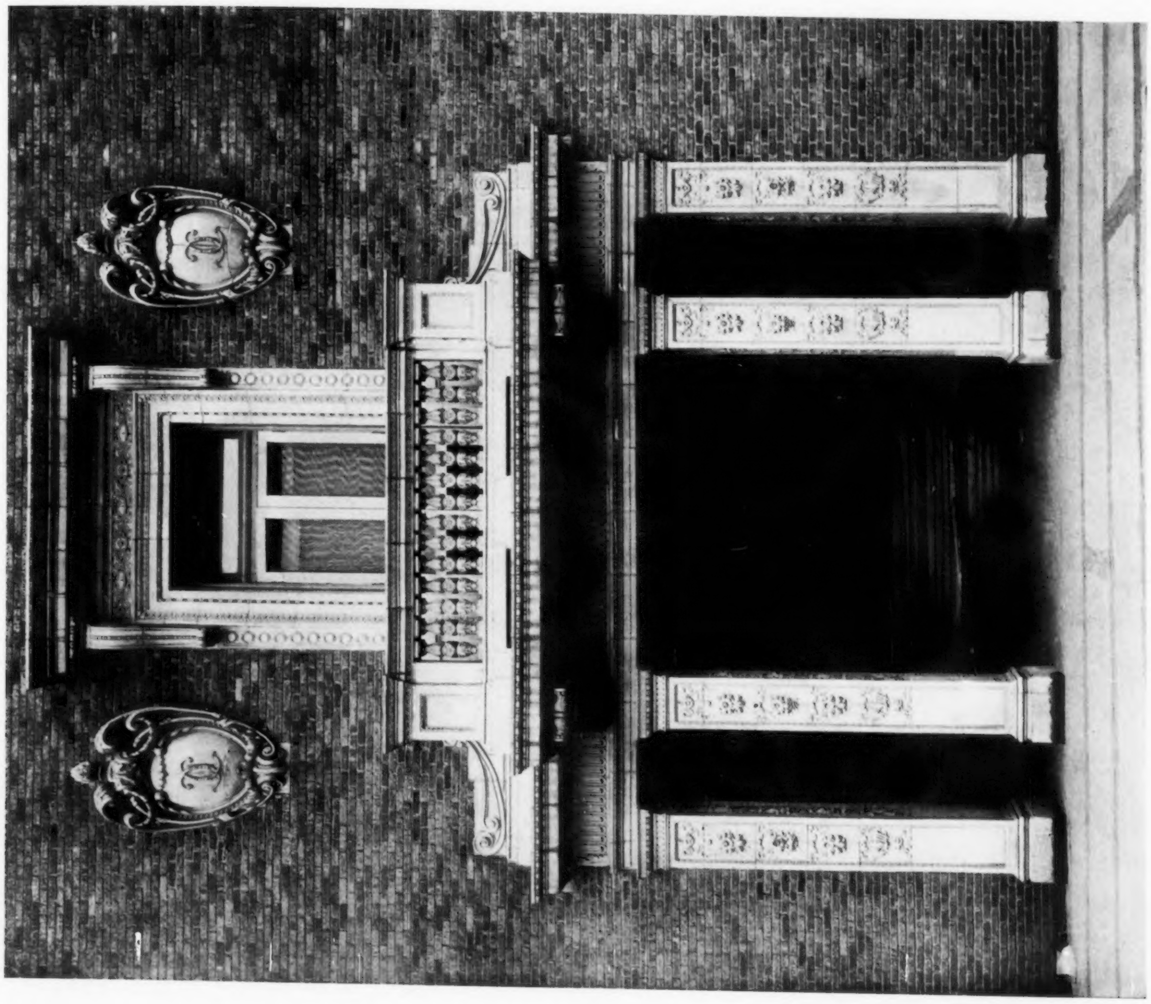
FIRST FLOOR PLAN



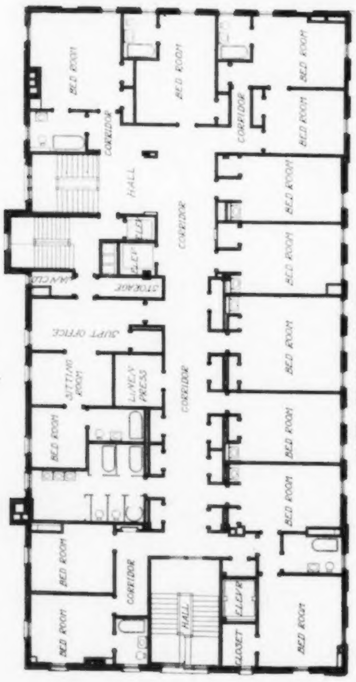
SECOND FLOOR PLAN

CAPITAL CITY CLUB, ATLANTA, GA.

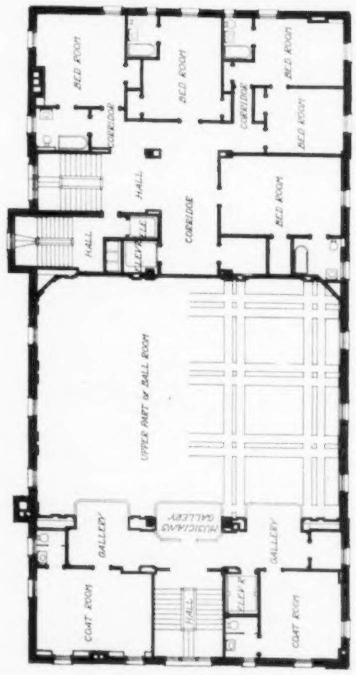
DONN BARBER, ARCHITECT



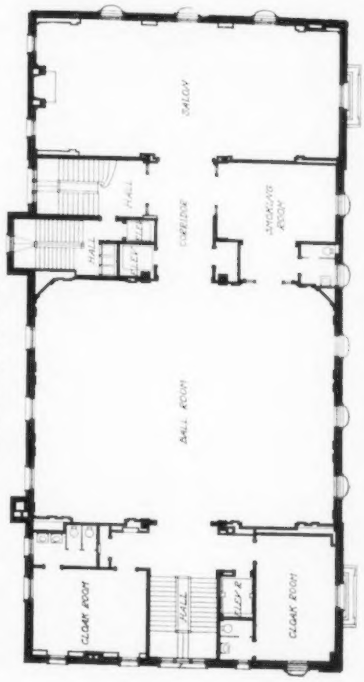
DETAIL OF LOGGIA



FIFTH FLOOR PLAN

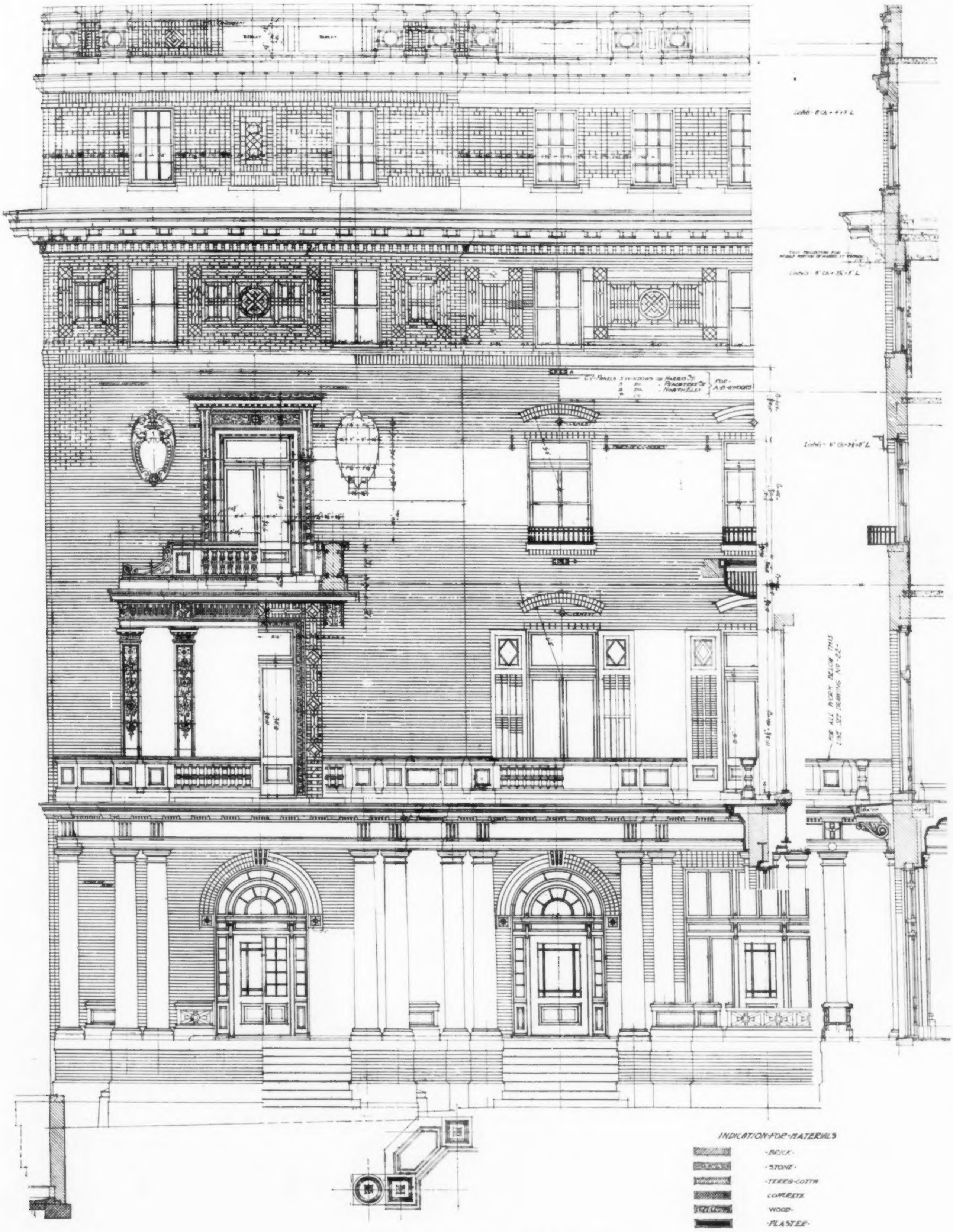


FOURTH FLOOR PLAN



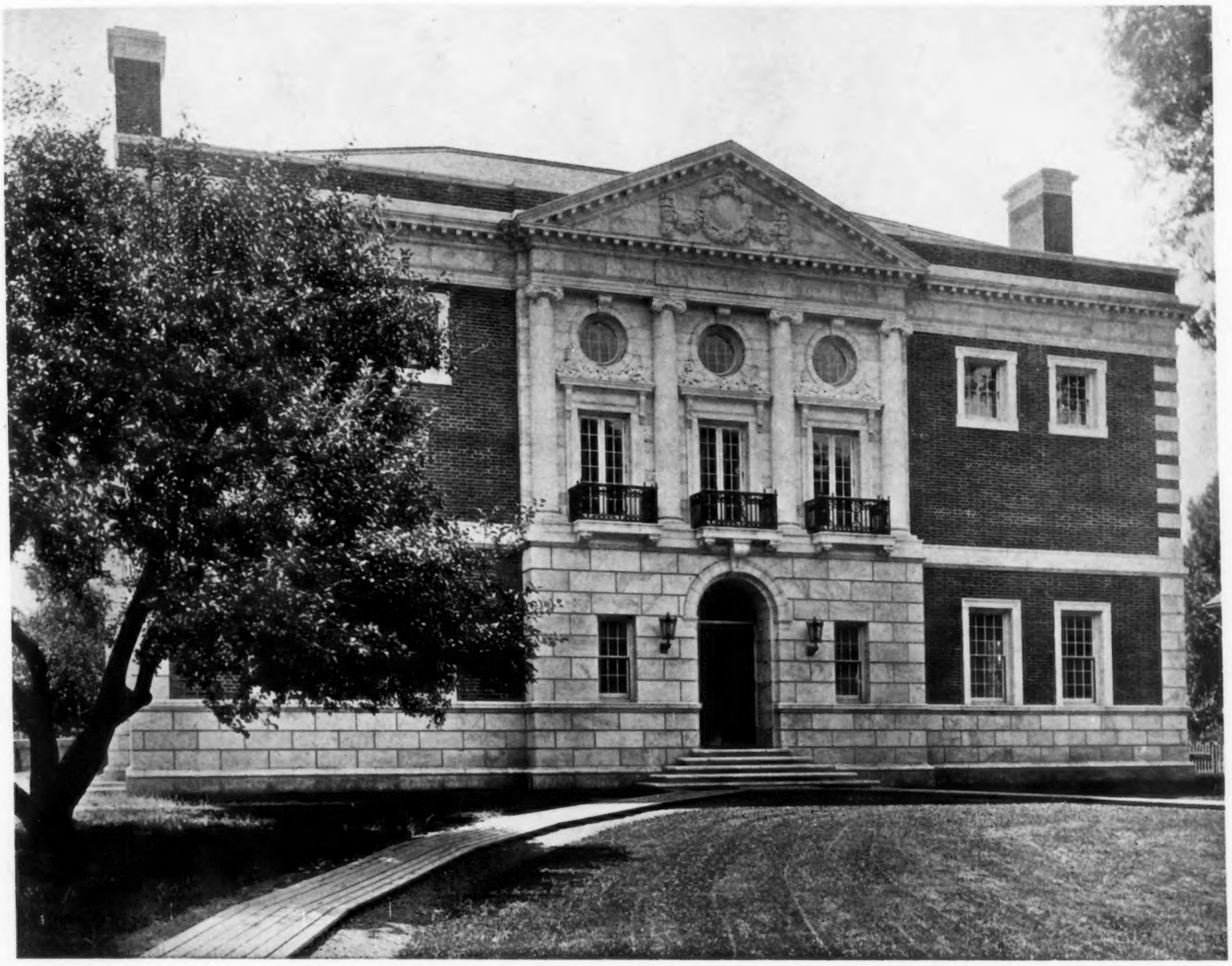
THIRD FLOOR PLAN

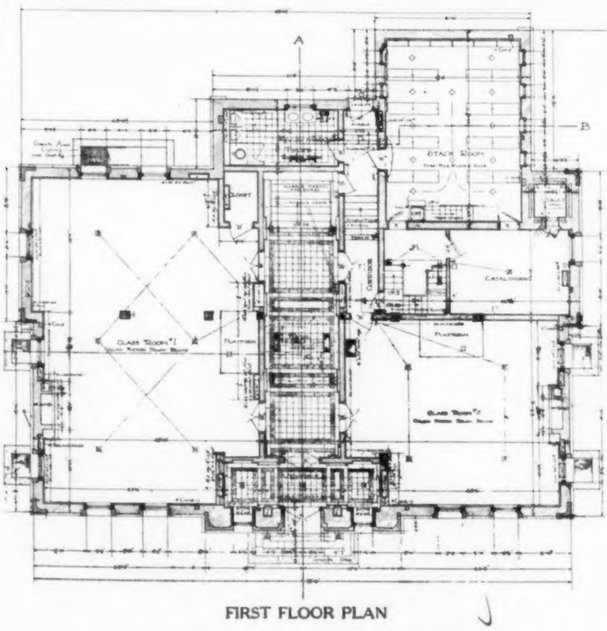
CAPITAL CITY CLUB, ATLANTA, GA.
DONN BARBER, ARCHITECT



CAPITAL CITY CLUB, ATLANTA, GA.

DONN BARBER, ARCHITECT





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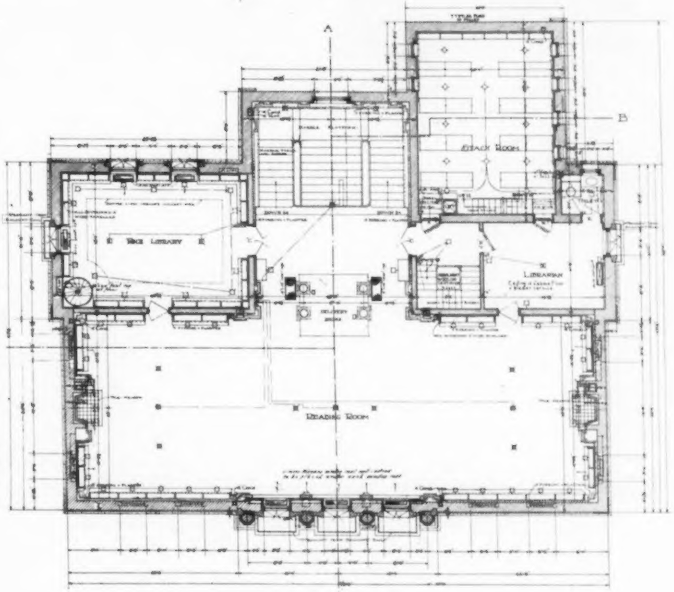
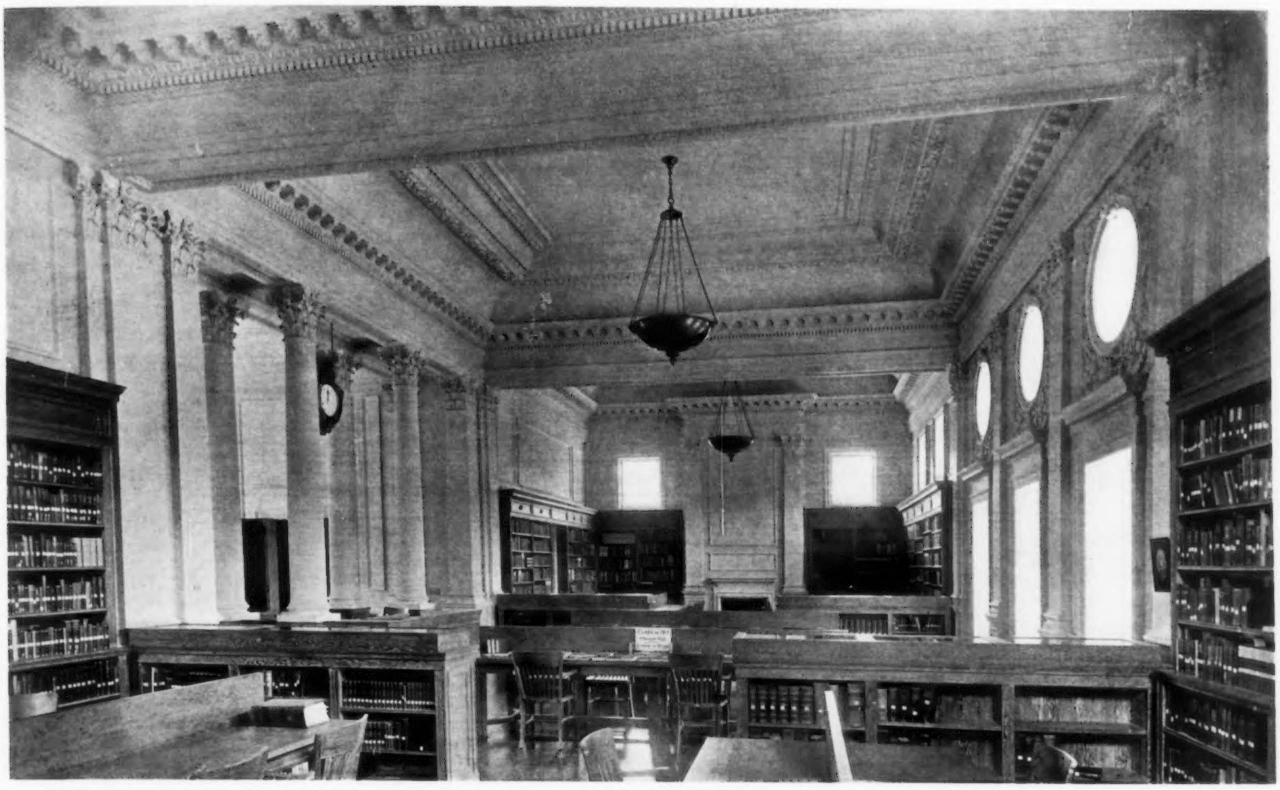


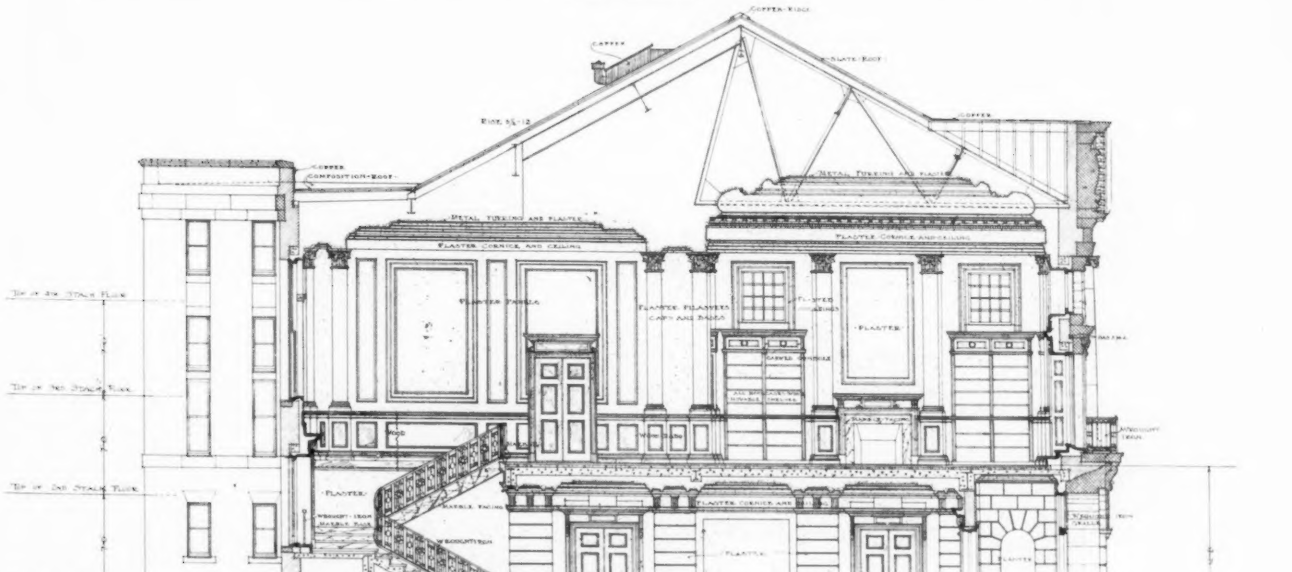
SECOND FLOOR PLAN

DAVIS LIBRARY, PHILLIPS EXETER ACADEMY, EXETER, N. H.

CRAM, GOODHUE & FERGUSON, ARCHITECTS



READING ROOM

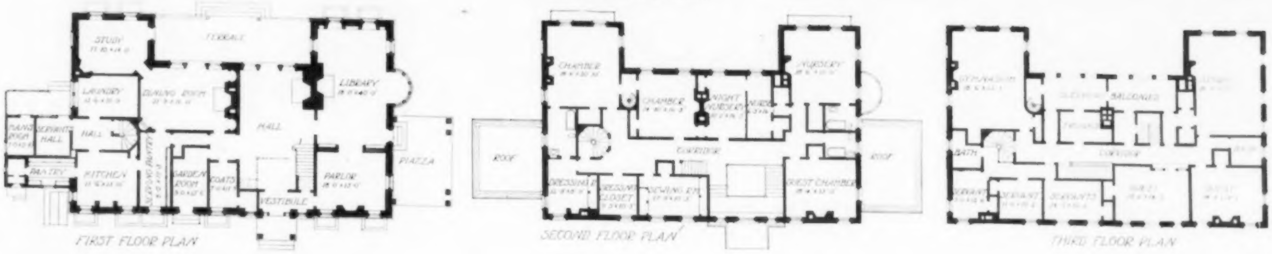


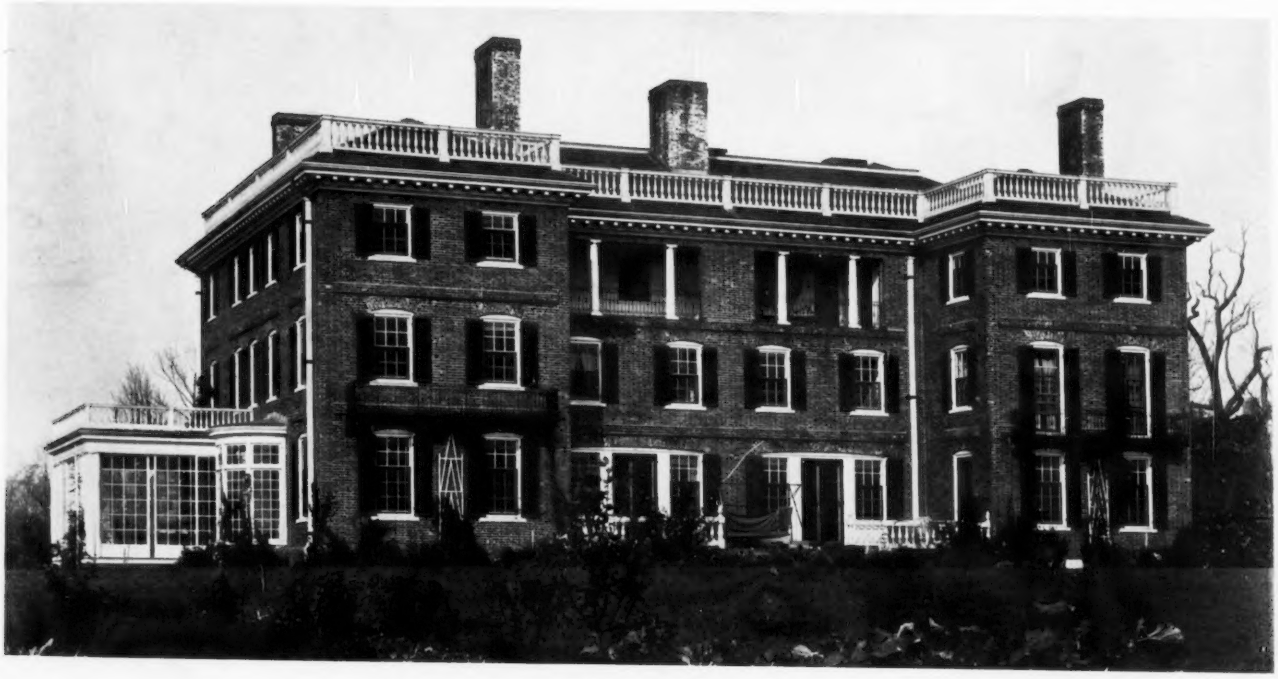
CROSS SECTION

DAVIS LIBRARY, PHILLIPS EXETER ACADEMY, EXETER, N. H.

CRAM, GOODHUE & FERGUSON, ARCHITECTS

ENTRANCE FRONT





GARDEN FRONT

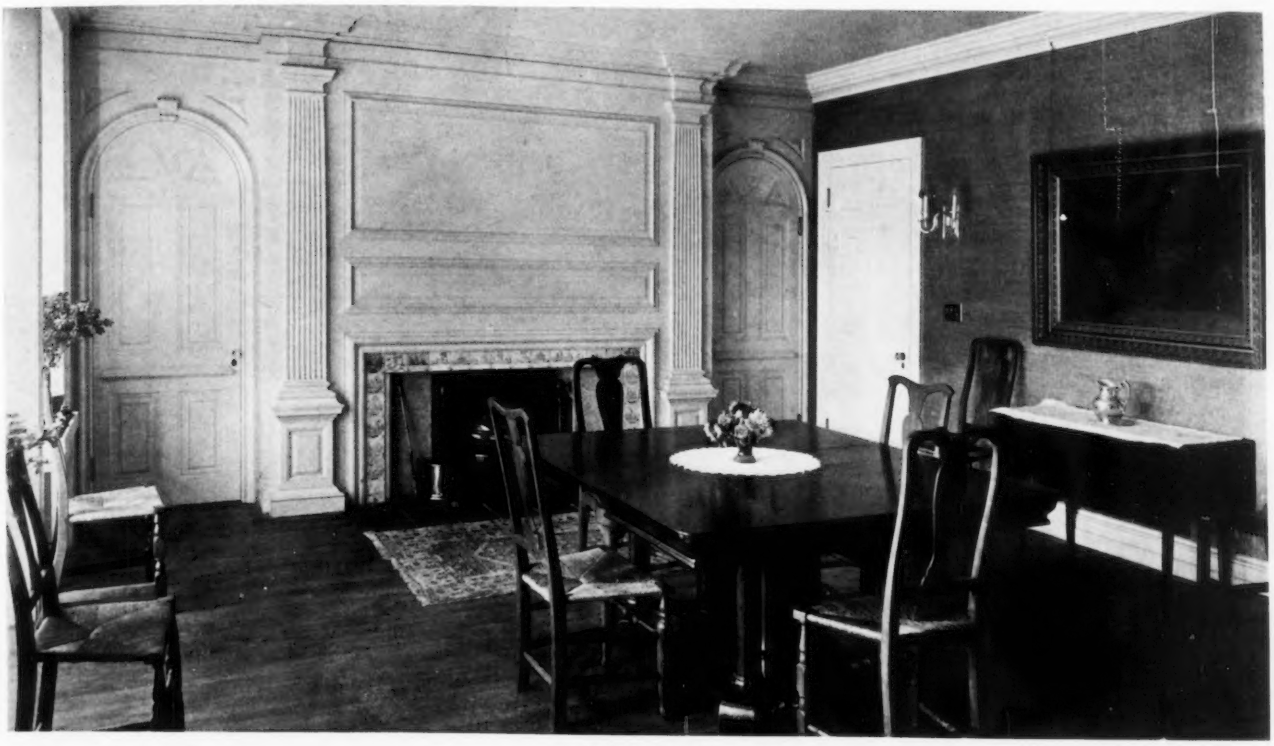
HOUSE AT CAMBRIDGE, MASS.

JOSEPH EVERETT CHANDLER, ARCHITECT

LIVING ROOM

STAIR HALL

HOUSE AT CAMBRIDGE, MASS.
JOSEPH EVERETT CHANDLER, ARCHITECT



DINING ROOM

MANTEL IN HALL

HOUSE AT CAMBRIDGE, MASS.
JOSEPH EVERETT CHANDLER, ARCHITECT

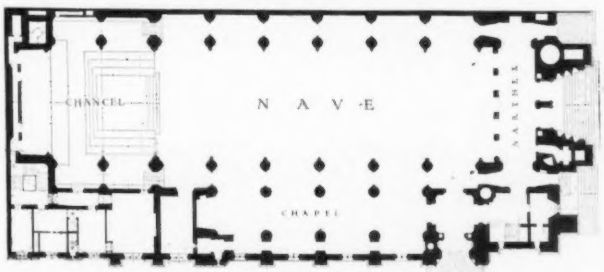
DISTINCTIVE AMERICAN ARCHITECTVRE

A SERIES OF ILLVSTRATIONS OF THE MOST NOTABLE WORK OF THE YEAR WITH APPRECIATIVE TEXT *BY*

MONTGOMERY SCHVYLER

The New St. Thomas's Church Fifth Avenue, New York City

CRAM, GOODHUE & FERGUSON, ARCHITECTS



Plan.

Detail of Rose Window and Carving on East Front.

THE new St. Thomas's in New York is already recognized as the most successful Gothic church in that city, barring the success of Old Trinity at the head of Wall street, which has held a proud preëminence among the Gothic churches of the city ever since it was consecrated in 1846. Rather curiously it happens that Richard Upjohn, the architect of Old Trinity, was also the architect of the original St. Thomas's which was destroyed by fire some years ago. It is true that his son, Richard M., is the architect of record, but equally true that, at the time of its erection, the church was commonly ascribed by architects to the original Richard. Still more curiously that the modern demand for the "accommodation" of a congregation, which, as we shall see, has been the essential requirement in the differentiation of the new St. Thomas's from the strictly "Anglican" type of ground plan, was also the urgent requirement in the designing of the St. Thomas's of the early seventies. This was by no means a requirement of a medieval Gothic church. Quite the contrary. As to the layman, the requirement of the medieval Gothic church, so far from betraying any disposition to "accommodate" him, was that he should be put in his place and made to feel that he was a worm, blessed above his deserts in being permitted to gaze from afar, in the dim recesses of the vaulting of the nave or the aisles, upon the celebration of the "mysteries" which was going on in the full light of the choir. Since then the layman has reclaimed his rights and has refused to be relegated to the shadowy background of what is going on. He pays, and he has to be conciliated. He is conciliated in modern Gothic to the extent that his opinion that the preaching holds the first place in the attractions of the church, and that the celebration of the "mysteries" takes a place quite secondary and subordinate, simply has to be taken by the modern architect as the basis of his design.

So long ago as the early seventies, when the old St. Thomas's was built, so old and so old-fashioned an architect as Mr. Upjohn was then had to take professional notice of the new requirement. The St. Thomas's of that day was under construction contemporaneously with the Church of the Holy Trinity, at Madison avenue and 42d street, slangily known, when it was new, as the "Church of the Homely Oil Cloth," by reason of a rough mosaic of colored brickwork which was spread over the second tier of its windows. This latter

was distinctly an "auditorium" church in its interior, although the exterior expression of the auditorium was by no means complete. The subsequent attempt of an ill-informed rector to take the force and meaning out of the design, much like the attempt now in progress to take the force and meaning out of the design of the Cathedral of St. John the Divine, resulted in the assuagement of the sorrows of lovers of architecture when the church, thus "marred by traitors," was finally put out of its misery by being demolished. Its architect, Leopold Eidlitz, was an architect who followed his logical conclusions to the bitter end. In speaking of Mr. Upjohn's solution of the modern, laic, "auditorium" problem in St. Thomas's, in comparison with his own in the Church of the Holy Trinity, he observed: "Mr. Upjohn's solution was to admit all the congregational accommodation that could be admitted, while retaining the traditional idea of a church. Mine was much more radical. I frankly abandoned the traditional idea of a church, and designed a theater with ecclesiastical details." This was, in fact, the difference. So timid and conservative an architect as Mr. Upjohn, excellent architect though he was, would hardly have varied from the traditional notion of a church without some precedent. He found this precedent in the octagon of Ely, which he modified on a small scale to meet the modern demand, as the architects of the Cathedral of St. John the Divine modified it on a large scale. The development of the "crossing," with the insertion of chapels in the angles of the accruing octagon, was the essence of the design of the elder St. Thomas's. It was not altogether successful, although the octagonal arrangement was clearly expressed on the outside, and although the lantern with which the corner tower was crowned was an undeniably picturesque and spirited feature of the frontage on Fifth avenue.

Detail of Turret on Rector's Residence.

What makes all this preliminary talk pertinent is the fact that the architects of the later St. Thomas's have found themselves "up against" the same condition which their predecessor encountered and have obviated it by even more strictly traditional means. Presumably the "accommodation" was one of the requirements imposed upon the competitors for the designing of the new church. The late William Martin Aiken was one of the judges of that competition, and was overheard to remark that he was much disappointed with the results of the competition, although he concurred with the other judges in considering the design of Messrs. Cram, Goodhue, and Ferguson the most promising for further elaboration of the submitted drawings. Whether by the conditions of the program or not, that design took as a datum the provision of more seating capacity than an orthodox Gothic treatment of the prescribed "lot" would supply, and undertook to provide for it by a novel method, neither that of the expanded crossing of the old St. Thomas's, nor that of the "amphitheater with ecclesiastical details" of the "evangelical" Church of the Holy Trinity. The expedient was adopted of what one may call a lay gallery on one side, and above the main floor, flanking the orthodox and conventional structure of nave and aisles.

Detail of South Entrance to Narthex.

This subordinate but still essential requirement of a superaddition to the main plan for the benefit of an importunate laity no longer negligible must be insisted on, in any analytic consideration of the design of the new St. Thomas's, for the reason that from it proceed all the "questionable shapes" and features of the design of the church. In the very interesting in-

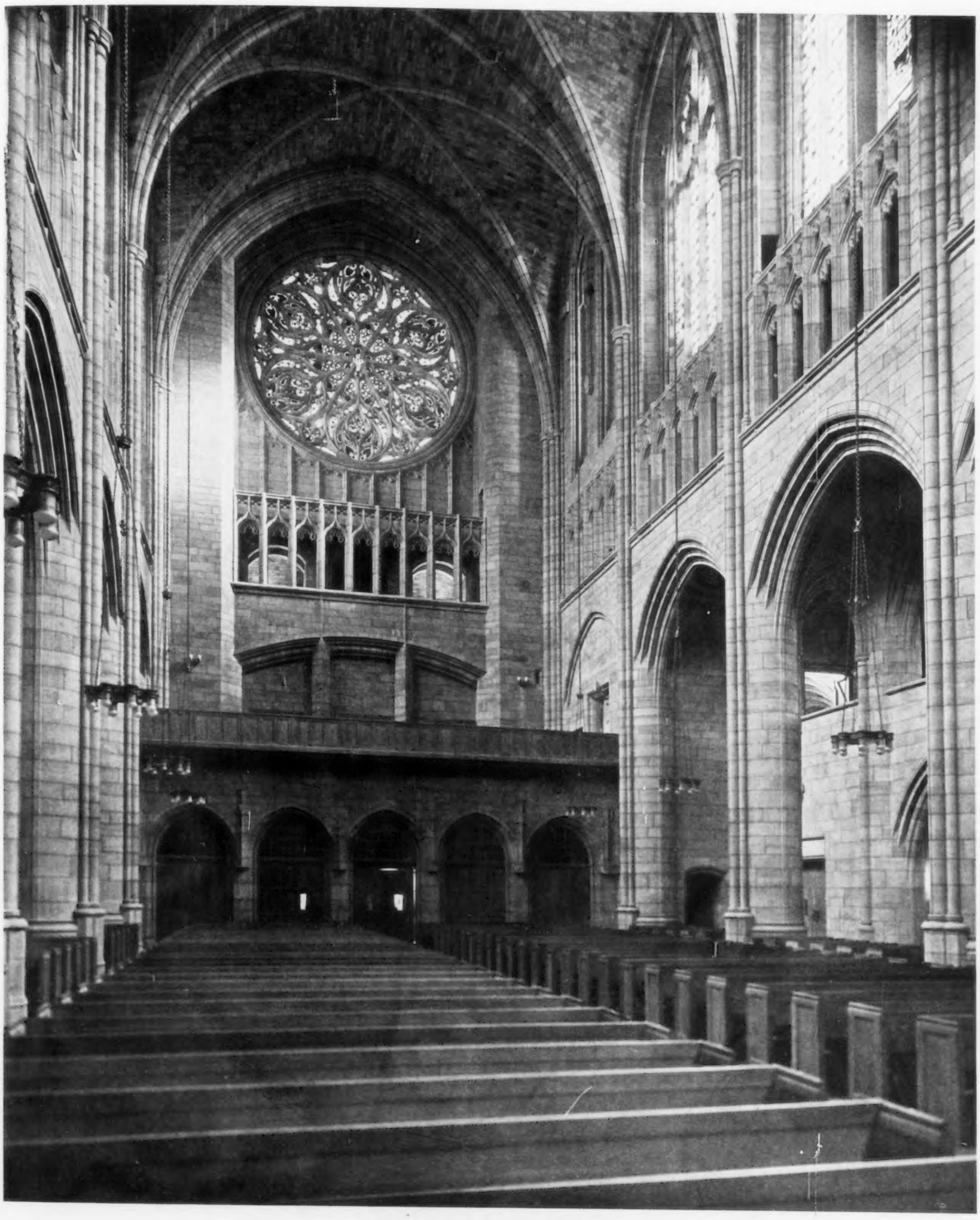
ST. THOMAS'S CHURCH, NEW YORK
CRAM, GOODHUE & FERGUSON, ARCHITECTS

Chapel at South Side of Nave.

terior it is this necessity of furnishing additional accommodation to the laity, in their gallery, on a plot procrusteanly limited, that has enforced the narrowing of the aisles of the regular ecclesiastical "lay out" to mere passageways, or "ambulatories." These ambulatories are of so much less than the conventional relation of width to their nave as to puzzle the spectator, unaware of the reduction of lateral pressure in the vaulting system adopted here, as to the means by which the thrust of the vaults of the broad nave is taken up. Properly speaking, this question is not an esthetic criticism. That is because, as in all Gothic work, the vaulting and its ultimate abutment are two things and not one, the vaulting belonging to the interior and the buttressing to the exterior, and the two never being seen together. There can thus be no contradiction shocking to the cultivated eye, and which, in the French phrase, "jumps to" the eye thus cultivated. It is only a mental puzzle, to be solved ultimately, and by reference to the "system" after the esthetic impression of interior and exterior has had its way and spent itself. Meanwhile, the impression of the interior remains. The simple vaulting of the broad nave, with its round piers rather emphasized than complicated by the simple reeding of the vaulting shafts, has the expression of an austerity amounting to asceticism, which belongs to Gothic so very "early" as hardly to be distinguishable from Romanesque. Indeed, the general expression of the interior is austere, perhaps the more so because the "square East end," geographically speaking the West end which, in authentic examples of English Gothic, goes so far to enliven the vista by its emblazoned expanse of painted glass, cannot here have that effect. Again it is the Procrustean limitation of the site. By reason of this, by reason of the impingement of the end upon secular and alien occupation, the "glorious wall" becomes impossible. It is only the lights in the upper stage that can be made to "tell." What enrichment can be applied below must be applied in the form of painting, mosaic, or pigmental, or else of the sculptured reredos already indicated in the drawings; in either case deriving its illumination either from frank artificiality or else from the upper openings, frontwise or lateral, for which alone the conditions give scope.

Exteriorly, and it is the exterior that has already made the new St. Thomas's the striking popular success it is, the enforced peculiarity of the plan is still more clearly responsible for all the questionable points of the architecture. The most questionable of these is doubtless the virtually equal division of the front between the gabled nave and the truncated tower, with its tall "diaphanous" belfry stage. When you know or recall the imposed, or assumed, necessity of a lateral gallery outside of the nave and aisles of the ecclesiological scheme, this division will no longer seem the freak it may have seemed to you at the first glance, but only the necessary expression of an unusual disposition. Moreover, you will come near to being astonished at the amplitude of space that has accrued from an arrangement enforced in the first instance by an exiguity of space. In the nearer bays, you find what you might call a terrace of massive buttresses, rising and receding as if there had been no question of space to

Chancel, Showing Organ and Carved Screen.
(The fittings of the chancel are temporary)



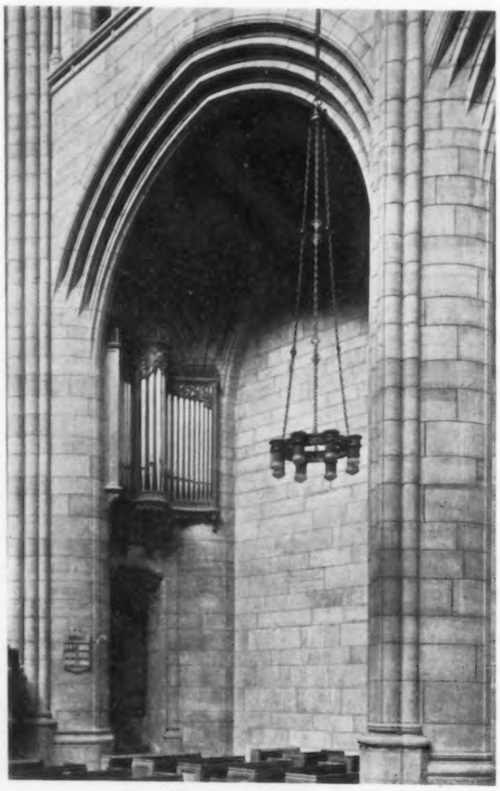
NAVE, LOOKING TOWARD NARTHEX

ST. THOMAS'S CHURCH, NEW YORK
CRAM, GOODHUE & FERGUSON, ARCHITECTS

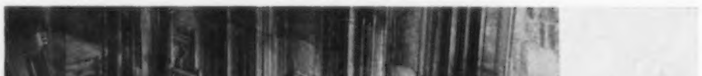
adjust on the Procrustean prescriptions of the "lot." Beyond these you find what in England might, in domestic architecture, be called the "offices" of the parochial plant, built, indeed, "to the limit" laterally, and carried to a much greater height than that of the buttressed aisle which they adjoin, but giving you, from the outside as well as from within, the sense of an amplitude of space very much greater than you could expect from the hard limitations of the scheme. Here, as elsewhere, the designers have plucked the flower safely from the nettle danger, or, as the prosaic architect must be fain to admit, this is highly ingenious planning.

If we have said nothing about the artistic effect of this technical achievement, it is because the illustrations speak for themselves in this regard. The architectural investiture of the skeleton we have been endeavoring to explain offers, as the inspector of these illustrations will admit, surprising turns of expressiveness and beauty. It were tedious to particularize, but one may be allowed to call attention to such features as the rose window, which, with all the medieval precedents for it, appears here to be quite unprecedented; to the tall belfry lights; to the "imitation" on the flank of the predominant turret of the tower; to the tall gallery that masks the gable, as old as Notre Dame de Paris and may be older, but gaining here a virtual novelty by its treatment. In fact, the two visible fronts abound in suggestions. But a point which the student who has not seen the building itself is almost certain to miss is the luck the design has had in being carried out in the material chosen, — a limestone almost white, with curious and random splashes in it of a darker tint.

As the "firm" which signed the plans for St. Thomas's has been dissolved or resolved into its elements since the completion of the edifice, there can be no harm now in saying that whereas the plan of the church was that of Mr. Ralph Adams Cram, the working out and all of the detail should be ascribed to Mr. Bertram Grosvenor Goodhue.



Detail of Bay in Nave.



Detail of Carving at East Entrance.

The Continental and Commercial National Bank Building, Chicago, Ill.

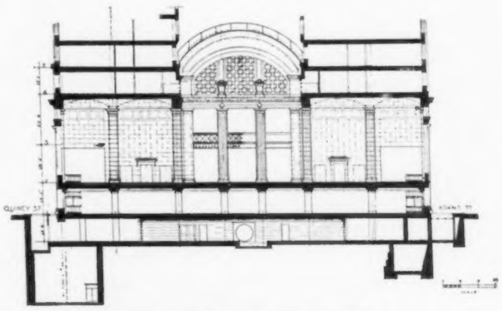
D. H. BURNHAM & CO., ARCHITECTS.

IT IS said, and with truth, that the art which employs materials successfully is as real as that which constructs with permanence and economy. Without construction, building is impossible ; but unless exercised in suitable materials with a proper sense of their nature and serviceableness, fine architecture is equally unattainable.

In the building for The Continental and Commercial National Bank, the architects have evidenced a technical sympathy with the materials in which they designed. This is easily recognizable in the treatment of the architectural terra cotta which has been used on the four street façades from the third floor level up through seventeen stories and attic. The esthetic value of a building material, whatever its nature, has to be expressed by its use and workmanship, form deriving character from its natural qualities. It is therefore by means of this esthetic expression of the texture of terra cotta that the fine effects of the architecture of this building are realized.

The building covers an entire city square in Chicago, bounded by streets on all sides, and in this respect is unique as a bank and office building in that city. The new home of the bank was designed in its essential features during the lifetime of the late Daniel H. Burnham and is one of the last of the many great undertakings with which his name is associated.

The first two stories are completely occupied by The Continental and Commercial National Bank, which to-day is the second largest bank in the country. The upper stories are divided up for offices. The main entrance to the bank is located on La Salle street, this being the principal banking street in Chicago. This entrance feature is emphasized by noble granite columns carried up four stories in height and with corresponding treatment of the terra cotta for the upper stories. On the Adams street side the ground floor is occupied by the Hibernian Banking Association and on the Quincy street side by the Continental and Commercial Trust and Savings Bank, subsidiaries of the main institution.



Transverse Section Looking West.

General View from Perspective Drawing.

The main banking room occupies the second floor and in some portions is four stories high, reached by two monumental staircases in the center of a large corridor near each entrance. The banking room is lighted by daylight through the barrel vaulted glass ceiling which serves the double purpose of ceiling and roof for the entire area of the open court. The interior court is 54 feet wide by 155 feet long. It is faced with white terra cotta and enameled brick. The sectional drawings illustrate the banking room and the floors beneath.

In all senses of the word this building is a modern fireproof structure. It is the last word in construction, heating, ventilating, etc. The structure is of steel with flat floor arch system, on caissons built upon solid rock.

Impervious terra cotta of a beautiful yellowish gray, softened by inconspicuous brown spots, was the material successfully used in the building. This combination of colors was the result of exhaustive experiments for this specific purpose. The factor of color in architectural work is one upon which stress should be laid. Most architects whose work is pleasing in its relationship of color have succeeded by begging the question and by using in place of really positive colors a monotone scheme. This scheme was employed in the subject under consideration and is highly successful. The surfaces are warm, sympathetic, and rich. In laying out the work special care was taken to arrange the jointing agreeably. All joints in ashlar as set were raked ¼ inch deep, thus displaying joints as clean-cut black lines.

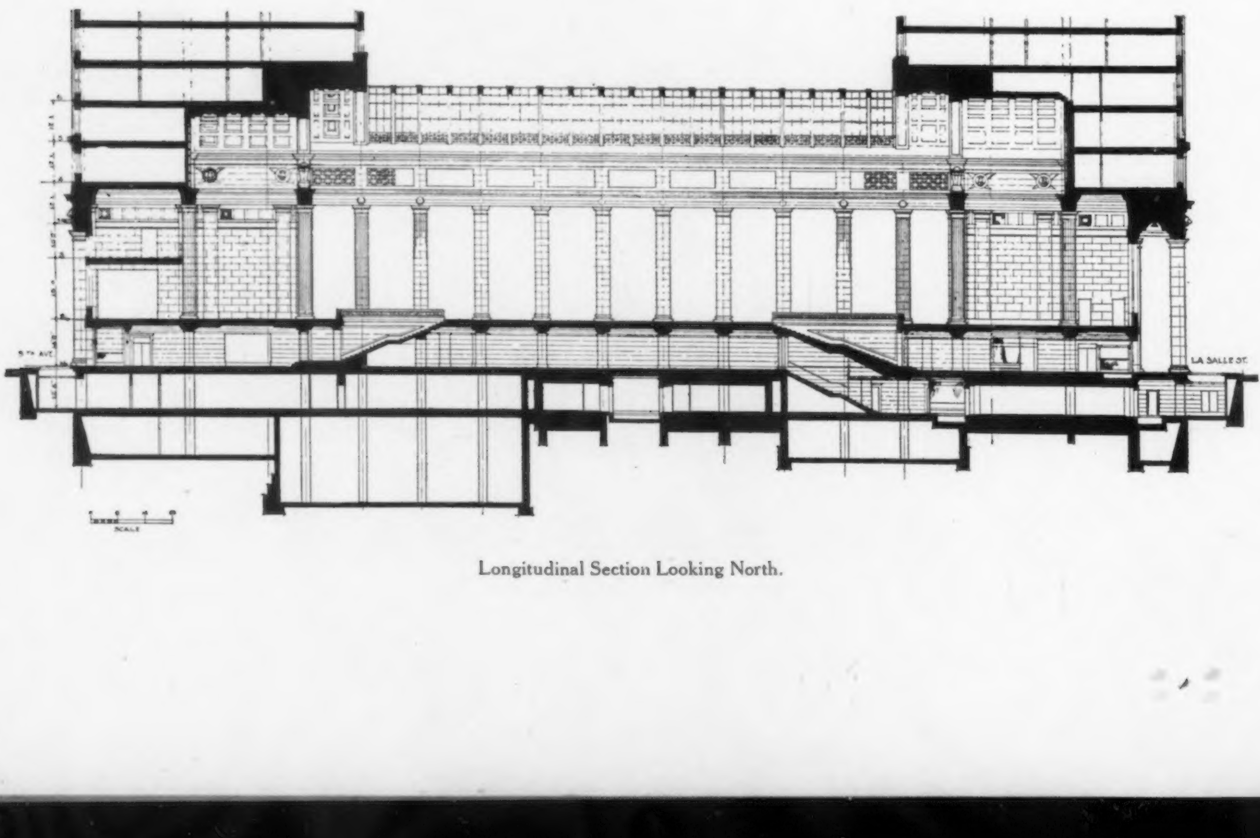
Architectural terra cotta, though a constructive element, has, however, an esthetic quality if it governs, as it should, the genesis of detailed form. It imparts the quality of texture which is beginning to be better understood in this country. That the architects have given thoughtful study and consideration to its use in this particular instance is to be remarked upon. The employment of this material has endowed the work with direct interest and beauty.

Two interesting drawings are here presented to illustrate the construction and to show how the exterior terra cotta finish was attached to the steel skeletons. The other illustrations tell their own stories of the magnitude of this whole work and the general scheme of the design. The illustration adjoining, showing a corner of the building, is from a photograph taken from the only point from which the building may be viewed in its correct perspective. It is also the nearest in point of position to that taken in the rendered perspective, a reproduction of which is shown at small scale on preceding page.

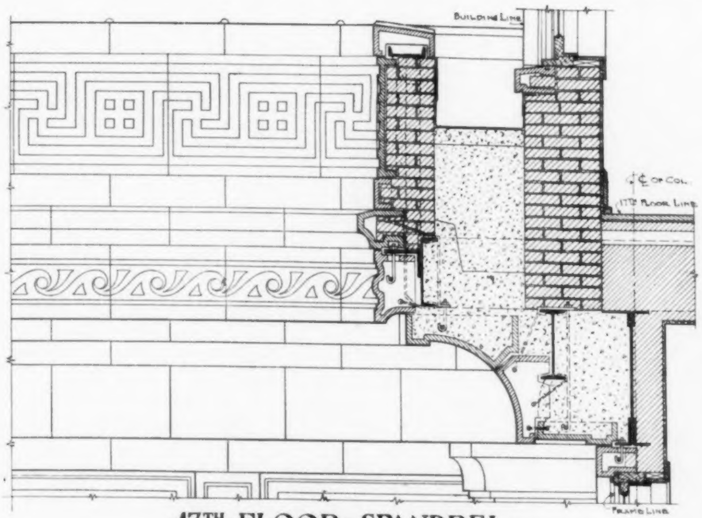
View Showing Upper Part of La Salle Street Front.

It is necessary to allow here that good building and good art are the same; the quality is properly common to both, admirable construction having beauty in building as well as in other workmanship. Construction as an art in entablatures, domes, vaultings, arcades, roofs, staircases, etc., offers abundant examples which do not permit the disintegration of artistic effect from constructive skill. It would seem that the architect of this building was emphatically the master of his work rather than the unwilling slave of untractable materials and awkward conditions. This is a sense conveyed to the mind by modern erection other than works of engineering. The conclusion is enforced that many architects have a genuine enjoyment in their handling of building materials and crafts and are able to express the means they employ to attain their ends in their work.

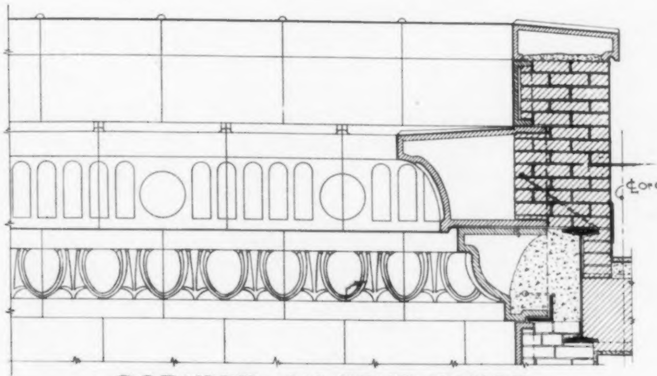
In the final analysis of this new building it can surely be said that dignity, fitness, and security are expressed alike by the material, construction, and arrangement.



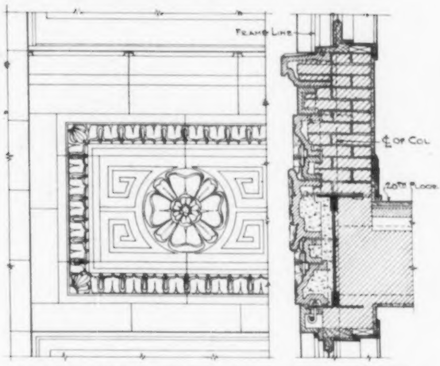
Longitudinal Section Looking North.



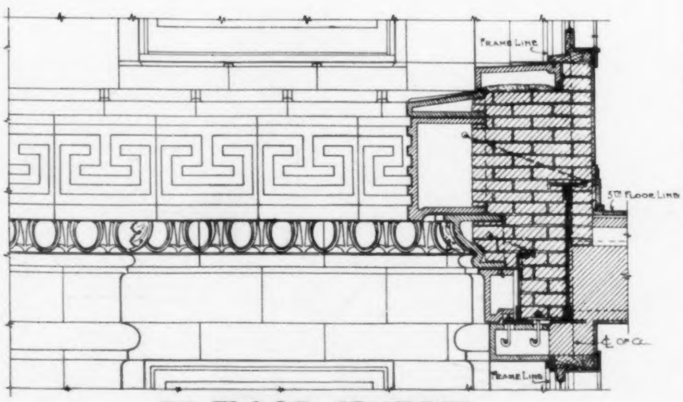
·17TH·FLOOR·SPANDREL·



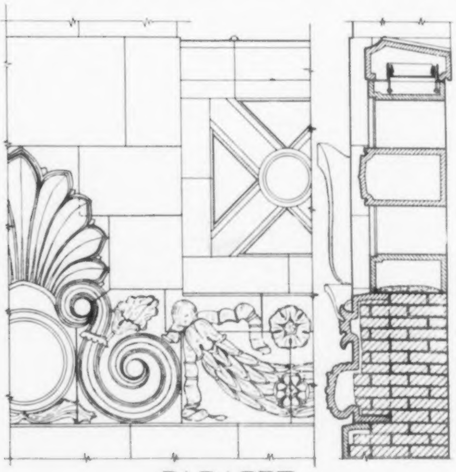
·CORNICE·ON·PENT·HOUSE·



·20TH FLOOR·PAVILION·SPANDREL·



·5TH·FLOOR·SPANDREL·

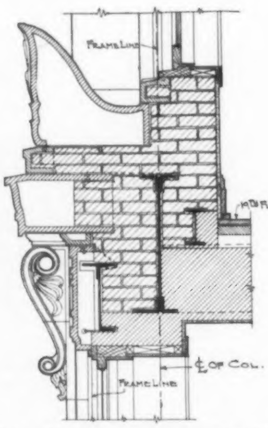


·PARAPET·

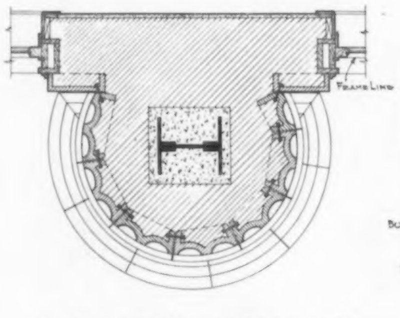
TERRA COTTA CONSTRUCTION DETAILS

CONTINENTAL AND COMMERCIAL NATIONAL BANK BUILDING
CHICAGO, ILL.

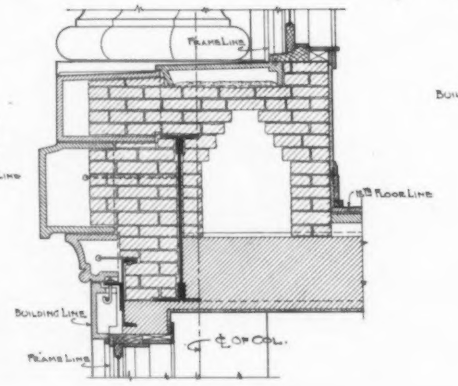
D. H. BURNHAM & CO., ARCHITECTS



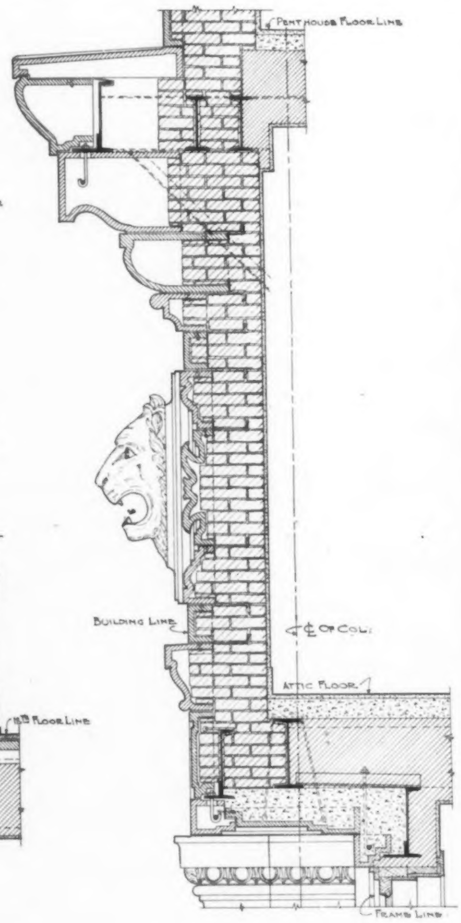
·19TH·FLOOR·PAVILION·
·SPANDREL·



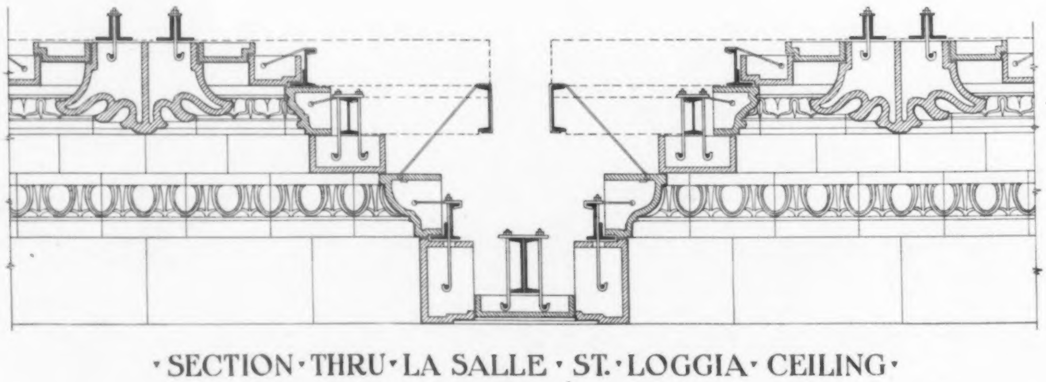
·PLAN·THRU·COLUMNS·
·AT·19TH·FLOOR·



·18TH·FLOOR·SPANDREL·



·MAIN·CORNICE·



·SECTION·THRU·LA SALLE·ST.·LOGGIA·CEILING·

SCALE ... FEET

TERRA COTTA CONSTRUCTION DETAILS

CONTINENTAL AND COMMERCIAL NATIONAL BANK BUILDING
CHICAGO, ILL.

D. H. BURNHAM & CO., ARCHITECTS

The Quantity System in Estimating.

GENERAL DISCUSSION.

Editors, THE BRICKBVILDER:

IT IS exceedingly interesting to note the different attitudes of your correspondents towards the quantity surveying system.

The subject seems to have been obscured by the suggestion that a reorganization or a radical improvement in the methods of preparing plans and specifications in architects' offices is a necessary preliminary step to the establishment of the quantity surveying system. This is not the case. The quantity surveyor's duty is to take plans and specifications as he finds them and from them compute the quantities of labor and material in the building. It is, of course, desirable that the plans and specifications should be good ones, and the better the plans the better his survey; but even with a poor set of plans he is likely (because of his greater experience and the facilities at his disposal) to make a better survey than half a dozen competing builders. But there is no basis for the idea that quantity surveying would of itself improve any architect's plans or require better plans than the contractor now gets.

The science of quantity surveying has only been in existence in England for about fifty years, and originated by builders who were asked to tender on a building meeting and appointing one from among their number to prepare their quantities, furnishing each with a copy to be priced, on which he would base his bid.

In order to reduce unproductive expense, these parties would agree that whoever got the job should pay the whole cost of preparing the quantity schedule, and so each one would add the cost to his bid before putting in his tender, and the owner would thus pay for the quantities without knowing it. In event of the bids being all rejected, the competing builders each paid a proportion of the cost.

Very soon independent surveyors took up this work and the benefits of a schedule of quantities made up by independent parties was soon felt, and before long architects realized the advantages to them in having the appointment of this surveyor in their own hands and in having the use of the quantities during the progress of the building and for the settlement of extras, so that it was not long before the quantity surveyor came to be appointed by the architect instead of being appointed by the competing builders.

Contractors are of two kinds and do their estimating in different ways. Mr. Blackall and Messrs. Isham and Cady speak of one type who figure work in a rough and ready way, sometimes by cubing the whole building, and pricing it at the same price per foot cube as the last similar building they put up, or else taking off a schedule of the materials and adding a lump sum price for labor. These guesswork, haphazard methods are survivals of a past day and generation and (although more commonly in use than we would like them to be) are steadily and surely dying out, especially among the larger contractors. The other type are those who carefully take off quantities in order to make up their estimates, and it cannot be denied that all the principal contractors on building work in the East do take off a schedule of quantities before making competitive bids, and that they price their labor by unit prices in accordance with the schedules in the same way. These are the men who are interested in the development of a quantity surveying system — men who at present do spend large sums in getting their bids accurate, only at last to lose the fruit of their work to some one who doesn't know how to make an estimate or has forgotten something.

I will go this far with Mr. Blackall in agreeing that there is *some* uncertainty about contracts in England, *some* latitude in estimates, *some* difference in profits, for the English system is not perfect; but I do not agree that they are as great as they are here, and especially in the range of estimates my English experience (which extended over twelve years) did not show me any jobs which were taken at ridiculously low prices except in one or two cases when, through pure carelessness, a builder priced out a whole bill of masonry and carried it into the summary with the decimal point set back a place, or a builder's clerk made a mistake in addition. No system will insure against errors of that sort.

It is not suggested that there will be any immediate demand for quantities on small jobs such as ten-roomed houses, small stores, etc., but the primary need comes on buildings costing $20,000 and over; this figure need not be a limit, but an economical limit will soon set itself.

It has not been claimed that the quantity surveying system will have any part in lowering or raising unit costs, and it also will make no difference whether bids based on quantities are accepted as lump sum contracts, or cost plus fixed sum with guarantee, or any other type of contract.

The way in which Mr. Jones refers to stringent blanket clauses in the contract and badly drawn plans would make it seem that, if all contracts were fair and impartial, and all plans clear and well drawn, there would be no need for quantities. But quantities are needed just as much in either case, with this difference,— that where plans are clear and specifications definite, the contractor would reap the primary advantage in being saved the labor of making an estimate of quantities; but where plans were not clear and specifications of the "blanket" type the owner would in a large percentage of cases reap the advantage.

The quantity surveying system, if adopted in this country, will eliminate one of the uncertain elements in present day building contracts, by furnishing each contractor with a schedule of the materials and labor shown on the plans, instead of leaving him to figure them out. It will not interfere with his own judgment in pricing or making up a bid. It will not necessitate any changes in architects' plans. It will not reduce fair competition or eliminate the careless or incompetent among builders or architects. It will not interfere with letting work under any type of contract the architect may desire, nor will it raise or lower costs. It is simply one logical forward step in the awarding of building contracts, the advantages of which must be experienced to be fully appreciated, but which seem apparent to all those who have carefully considered the subject.

LESLIE H. ALLEN.

EDITORIAL COMMENT AND NOTES FOR THE MONTH

IT IS the inalienable right of every one to think for himself, to form his own opinions regarding those matters with which he is intimately concerned. And undoubtedly every one has an opinion as to the outlook for building during the coming year. The very nature of our work brings us into touch with those who are identified with building operations in different parts of the country, and if we may intelligently judge from the opinions that come to us, we feel safe in predicting that there will be a general revival during the year.

Expansion in general business is always reflected, favorably, in the building field. As we all know, expansion in business is dependent upon wise legislation, a good crop outlook, and the attitude of banks and other institutions toward those who seek loans for the promotion of sound and legitimate business enterprises. To this let us add that optimism rather than pessimism is an important factor in creating and maintaining a healthy condition.

Taken as a whole, building operations for 1913 were very satisfactory. They were not as extensive in some parts of the country as in others, but this is natural and will probably always be so. The real depression came during the last two or three months and this depression was noticeable particularly in the larger cities. Here we find that a great deal of work which was already on the boards was ordered held up for one reason or another. Again, a great deal of work that had only reached the "interview" stage suddenly vanished. It will take but a short time when conditions have become more favorable to start this work going again, and to it will be added a great deal of new work, because cities and towns of this country are not overbuilt. The demand for most kinds of buildings has been equal to the supply. A period of hard times and consequent retrenchment in building operations is almost immediately followed by a corresponding increase.

Let us consider briefly those influences which do now and will continue to stimulate building operations. A rapidly increasing population must be housed. Electricity and the motor have reduced and are reducing distances with the result that new areas are being developed to provide new homes, schools, churches, business blocks, and manufacturing plants. The more prosperous among us will continue to build houses which will reflect modern thought in design, plan, and equipment. New inventions which administer to the comfort and material welfare of mankind will have a large influence in creating a demand for new hotels, apartments, hospitals, banks, libraries, theaters, office buildings, etc. Is this work likely to stop for any considerable length of time? Has it ever seriously stopped within the recollection of any man in practice to-day? We think not.

The practice of architecture is, generally speaking, influenced by two words, — "stop" and "go." The one is the spark that prostrates. The other brings into instant life every creative energy. Depression comes suddenly — you can tell it by the long line of draftsmen who hit the trail with a gloomy pine. Reaction is equally as sudden — you can tell it by the untrodden verdure that covers the trail. The word "stop" was undeniably uttered during the closing months of last year. Weighing — to the best of our ability and with the one thought of forming an intelligent estimate — the reports that have come to us from different sections of the country, we are of the opinion that the word "go" is soon to be passed down the line.

FOR some years there has been a strong movement on the part of the members of the National Association of Master Plumbers and National Association of Steam and Hot Water Fitters to secure the letting of their contracts by architects instead of general contractors.

It is interesting to the profession, therefore, to give here the resolution that was adopted at the last Annual Convention of the American Institute of Architects.

"*Resolved*, That the American Institute of Architects in convention assembled recommends to the members of our profession the adoption of the practice of direct letting of contracts for mechanical equipment, such as heating apparatus, plumbing, and electrical equipment. This recommendation is based on the conviction that direct letting of contracts as compared with sub-letting through general contractors affords the architect more certain selection of competent contractors and more efficient control of execution of work and thereby insures a higher standard of work, and, at the same time, serves more equitably the financial interests of both owner and contractor."

PRIZE WINNERS.

THE BRICKBVILDER'S ANNUAL ARCHITECTURAL TERRA COTTA COMPETITION.

THE Jury of Award for the Moving Picture Theater Competition awarded First Prize, $500, to Louis Fentnor and Robert Pallesen, associated, New York City; Second Prize, $250, to Thomas B. Herman and Dinardo & Beersman, associated, Albany, N. Y.; Third Prize, $150 to Gustave G. Vigouroux, New York City; Fourth Prize, $100, to James Flaherty, Boston, Mass. Mentions: Walter Scholer and David W. Carlson, associated, New York City; Robert R. Graham, Syracuse, N. Y.; LeRoy Barton and Walter McQuade, associated, Brooklyn, N. Y.; C. Hugh Ferber, Reno, Nev.; Harry E. Warren, Boston; Midgley Walter Hill, New York City.

The competition was judged January 10 by Winthrop Ames, Howard Greenley, Harry Creighton Ingalls, Albert Kelsey, Hugh Tallant, and Arthur Ware.